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ABSTRACT

Two hypotheses were tested: 1) that teachers would teach better if they received feedback through an in-class student response system, and 2) that student achievement would be higher in classes where the instructor received such feedback. Classes met in a room which was equipped with a student response system. The instructors asked students to continually indicate how well they felt they were understanding the material being presented. In the experimental sections this feedback was visible to the instructor; in the control sections it was not. Students' perceptions of their instructor's teaching were determined on "A Student's Rating Scale of an Instructor." The instructors measured students' achievement by tests. Results showed that the effect of the systematic student response varied significantly for the different instructors and therefore should be generalized to other instructors only with caution. Within this limitation, the first hypothesis was supported. The improvement seemed greater for instructors whose teaching style or size of class did not allow much verbal in-class feedback from students. The second hypothesis was not supported. (Author/JK)

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**The Effect Of Systematic
Student Response Upon
Teaching Behavior**

by

Jennis Joseph Bapst

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MEM 009 696

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University of Washington

Abstract

THE EFFECT OF SYSTEMATIC STUDENT RESPONSE
UPON TEACHING BEHAVIOR

by Jennis Joseph Bapst

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Both theoretical and experimental studies have suggested that the reception of feedback from students by an instructor through a student response system would result in a significant improvement in the instructor's classroom behavior. Moreover, these studies have suggested that this change in teaching behavior would result in significantly higher scores on subject matter tests for those students in classes in which the instructor was receiving feedback. The specific hypotheses which were investigated in this experiment are as follows:

I. Students will rate an instructor more favorably on qualities related to his classroom teaching behavior when he receives in-class feedback through a student response system than when he does not receive this feedback.

II. The measured achievement of students obtained from examinations of the subject matter of the course will be higher for the class in which the instructor is receiving feedback through the student response system than for the class in which he is not receiving this feedback.

The experiment was conducted using the RESYC Student Response System installed in the planetarium classroom at Mt. Hood Community College, Gresham, Oregon. The subjects were four regular full-time instructors employed by the college. Each instructor was teaching two sections of the same subject as part of his regular class load.

During the first five weeks of the quarter, the classes met in a conventional classroom and were taught in the instructors' accustomed manner. During the second five weeks, the classes met in the planetarium classroom which was equipped with the student response system. During the second five weeks the instructor solicited student feedback through the student response system by asking the students to respond to multiple choice questions and by asking the students to continually indicate on the student response system how well they felt they were understanding the material being presented. In the control section this feedback was not visible to the instructor; it was visible to him in the experimental section.

Student perceptions of the instructors; classroom teaching behavior were determined at the end of the first and second five-week periods on A Student's Rating Scale of an Instructor. The students' achievement was measured by the instructor-made tests used for grading purposes. For both the rating scale and the achievement tests an analysis of variance was performed to determine if there were any significant differences between the control and experimental sections at the end of the second five weeks, when any differences at the end of the first five weeks were taken into account.

The results of this investigation indicated that the effect of the systematic student response varied significantly for the different instructors and therefore should be generalized to other instructors only with appropriate caution. Within this limitation the results supported the hypothesis that certain instructors improved their classroom teaching behavior as perceived by their students when these instructors received in-class feedback through a student response system. There were indications that this improvement in student rating was greater for those instructors whose teaching style or size of class did not permit significant verbal in-class feedback from the students.

The results of this investigation did not support the hypothesis that the achievement of students on examinations of the subject matter of the course would be higher for the class in which the instructor received in-class feedback through the student response system.

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CHAPTER 1

INTRODUCTION, BACKGROUND, AND STATEMENT OF THE PROBLEM

Introduction

The lecture method of instruction in large classes seems to be a continuing part of college education as a means of handling the increasing numbers of students seeking higher education. These large classes permit at least a minimal contact between instructor and student and are useful for some types of instruction. Informational and factual material can be presented efficiently and economically in large classes; lectures to large classes can serve motivational functions; indeed, any instructional function which involves primarily one-way communication from instructor to student can be done in large classes with a lecture method of instruction. As summarized by Gagne:

A lecture can accomplish, or try to accomplish, a number of different instructional objectives. Among these are the following:

1. It can establish and augment motivation to achieve.
.....
2. It can inform learners of the expected outcomes of learning.
.....
3. It can attempt to provide prompting and guidance to learning. ¹
.....

Since most of the financial support of public institutions of higher education is based upon the number of students and the credits they earn,

¹Robert M. Gagne, The Conditions of Learning (2nd ed.: New York: Holt, Rinehart and Winston, Inc., 1970), p. 370.

large classes with their low cost per student permit other instructional activities which are nearer the ideal of individualized instruction. Small discussion groups, seminars, tutorial sessions, and other instructional arrangements with a high cost per student would not be possible without the counterbalancing low-cost-per-student large classes. Therefore it is important that continuing efforts be made to improve large class instruction.

New instructional media are being developed for the presentation of material, interaction with students, and evaluation of large classes. Closed-circuit television, videotaping, rear screen projection, overhead projectors, test scoring machines, student response systems, and many other devices have been developed to aid in large class instruction. The reasons for continuing large classes and the problems for instructional media that such large classes present were summarized recently in a publication which reviewed the development of new media for classroom instruction.

Although large classes often are criticized, such arrangements may be most useful as a means for carrying out some kinds of instructional functions. Large classes will probably continue to be scheduled as one means of dealing with large numbers of students, partly because they make possible other arrangements to realize the ideal of individualized instruction. Large class meetings do not preclude the use of other complementary instructional and learning procedures for serving other and different functions. The problem of the large class or multisection course is a good test case to consider for applications of new technologies.

Specialized classroom buildings, seating from 1,000 to 3,000 students, are being constructed and equipped in American universities....There are very special and interesting problems involved in equipping buildings or classrooms which are designed for use by large numbers of students. The building typically provides the characteristics of the general learning environment. Internal climate control, excellent acoustics and lighting, seating and spacing of seats for comfort, and arrangements for efficient student traffic flow are all required. Within these large classrooms, the instruction-learning cycle begins at the point

when instructional materials of proven quality are available.¹

Another factor that will insure the continued use of lecture methods in large classes is the absence of any clear research evidence which indicates the superiority of other teaching methods or the inferiority of the lecture method. In a review of research evidence comparing the lecture discussion method which cited studies from the year 1931 through 1956, the author made the following observations:

With respect to immediate mastery of factual information, most studies find no significant differences between lecture and discussion methods...a few studies do report differences, usually in favor of the lecture...but not always. Of three studies which dealt with ...[the important question of retention] two found retention of material to be superior in groups taught by the discussion method and one found no difference.... Further, students of less ability showed greater immediate recall of information under the lecture method whereas the "method" made little difference in such performance on the part of the more able students. It should be noted that all of these studies have been taken at the college level.²

Since large class instruction using the lecture method -- especially when augmented by instructional media -- presents the possibility of effectiveness, efficiency, and economy, investigation of the interaction between the instructor, student, and instructional media is indicated.

¹C. Ray Carpenter, "Instructional Functions of New Media," in New Media and College Teaching, ed. by James W. Thornton and James W. Brown (Washington, D.C.: National Education Association, 1968), p. 8.

²Norman E. Wallen and Robert M. W. Travers, "Analysis and Investigation of Teaching Methods," in Handbook of Research on Teaching, ed. by N. L. Gage (Chicago: Rand McNally and Co., 1963), p. 481.

Background of the Problem

Instruction-Learning Cycle: Large Classes

In order to organize and describe the interaction among instructor, students, and instructional media in large classes, Carpenter has constructed a three-phase model of the instruction-learning cycle.

Phase one is the display-perception phase. Included here are all the kinds of apparatus used in presenting stimulus materials to a large class. Generally, these presentations are in the visual-auditory modes.

.....
The second phase is learner interaction and response. Despite the prominence of this second phase in the reports of research and learning theory, the practical equipment for instrumenting this second phase of the cycle is retarded compared with the equipment for display.

.....
Phase three as described requires that conventional testing and evaluating functions be made integral parts of the instructing and learning processes, and that assessing the students' performances be considered an essential part of the instructional cycle.¹

In his discussion of the state of research and development regarding three stages, Carpenter states, "...at present the display of stimulus material is very highly developed compared with equipment that is available for implementing the other phases of the instruction-learning cycle." He goes on to say, "Instrumentation of this [second] phase is an essential but still underdeveloped step for connecting phase two with phase three of the cycle."²

Electronic student response systems have been developed to serve Carpenter's phase two (learner interaction and response) and phase three

¹Carpenter, "Instructional Functions of New Media," pp. 8-9.

²Ibid., p. 9.

(reactions of students to stimulus materials). Boardman described five student response systems in use at junior colleges.¹ All of the systems advertised that their benefit derived from the immediate reinforcement to students and feedback to the instructor of knowledge of the results of his instruction. Johnson, in a short review of student response system, states:

This facility is useful in teaching large groups without losing values of active student participation in the learning process. Moreover, an instructor can periodically question students in order to determine the effectiveness of his teaching and to aid in reinforcing learning by maintaining the attention of individual students.²

In its present, most common form, the student response system consists of a student responder electrically linked to an instructor display unit. The student responder has five pushbuttons labeled A, B, C, D, E. The student uses the responder to indicate his answer to an objective-type question posed by the instructor. The instructor display unit consists of an array of individual lights corresponding to the seating arrangement, plus a set of five indicators which display the percentage of the class which has selected each response probability. When the instructor selects one response as the correct one, the individual lights in the seating array indicate which students have selected that response, which ones some other response, and which ones did not respond at all. Lights on the student's responder indicate whether he has selected the correct response. Most commercially available student response systems also make possible permanent recording of each student's response.

¹Doris E. Boardman, "The Use of Immediate Response Systems in Junior College," (unpublished seminar paper, University of California in Los Angeles, March, 1968).

²B. Lamar Johnson, Islands of Innovation Expanding: Changes in the Community College (Beverly Hills, California: Glencoe Press, 1969), p. 146.

Communication Theory

The use of a student response system in large class lecture situations is strongly suggested by the concept of feedback included in modern communication theory. Berlo has attempted to synthesize a number of communication models and has come up with the following ingredients in the process of communication:

1. the communication source
2. the encoder
3. the message
4. the channel
5. the decoder
6. the communication receiver
7. the feedback¹

In the teaching situation the instructor is both the communication source and encoder. He takes the facts, concepts, etc., which he wishes to communicate and encodes them into words, written symbols, or other stimuli (the message) which he presents to the senses of the students through whatever channel is available to him. The channel may be simply the instructor's voice as in the traditional lecture; the channel may be a closed-circuit television arrangement; or the instructor might be using a video tape presentation, a motion picture film, an overhead projector, or any of the various display-perception devices in phase one of Carpenter's model. The first

¹David K. Berlo, The Process of Communication (New York: Holt, Rinehart and Winston, Inc., 1960). [The first six items are developed in Chapter 2, "Model of the Communication Process." The concept of feedback is introduced in Chapter 4, "Learning," and expanded in Chapter 5, "Interaction."]

phase is already well-developed, at least with respect to instructional media. The decoder and communication receiver is the student. His sensory organs decode the message and thereby the message is received.

The fidelity of this process depends on all parts of the process. The communication source must be skilled in encoding. The message must be transmitted in its entirety through the channel and not be changed by that transmission. The decoder and communication receiver (student) must possess the same codes as the encoder and communication source (instructor) and be capable of receiving the stimuli presented by the message. The process of communication is fraught with opportunities for inaccurate transmission of the message from the source to the receiver. In order to provide a check on the fidelity of the process of communication, feedback must be provided. This feedback, according to Berlo, is a special aspect of receiver reaction.

It names the use which the source can make of this reaction in determining its own success....The source can use the reaction of the receiver as a check of his own effectiveness and a guide to his future actions. The reaction of the receiver is a consequence of the response of the source. Feedback provides the source with information concerning his success in accomplishing his objective. In doing this, it exerts control over future messages which the source encodes.¹

It is exactly this feedback which is not provided in the usual large class lecture situation. In person-to-person communication, the receiver and communicator are continually switching roles so that they can interact to check the accuracy of the messages each one is sending and receiving. This verbal interaction is the main source of feedback from student to instructor in small classes. In lecture situations some instructors claim

¹Berlo, The Process of Communication, pp. 112-3.

that they can use various non-verbal cues such as eye contact, body posture, and facial expression to gauge how well students are understanding them. A study which assessed teacher accuracy in judging student level of comprehension found that when only visual cues were present both inexperienced and experienced teachers were inaccurate in judging student comprehension.¹

The study involved teachers viewing a motion picture film of a group of students in a class. When only the picture was shown, the teachers were not able to judge accurately how well the students were understanding. When the sound was added, such judgments could be accurately made. Unless an instructor addressing a large class has some way of interacting verbally with at least some members of the class, he does not really know whether the students are comprehending.

Carpenter's three-phase model of the instruction-learning cycle is quite similar to the conceptual model for communications research developed by Westley and MacLean. This model is diagrammed in Figure 1. In this model, X represents any object or event that has characteristics capable of being transmitted in some abstract form. A is the communicator who selects from these Xs and transmits a message to B. B may or may not have part or all of the Xs in his own sensory field. B then receives the message from A and feeds back either purposively or nonpurposively information about how well he received the message. A can then compare the feedback from B with his own notion of X and either go on with other messages or, if there is a discrepancy between the feedback from B and A's notion of X, try to send another message to B which will give a more correct impression.

¹Jon Jecker and others, "Teacher Accuracy in Assessing Cognitive Visual Feedback from Students," Journal of Applied Psychology, XLVII (No. 6, 1964), pp. 393-7.

Model for Communications Research

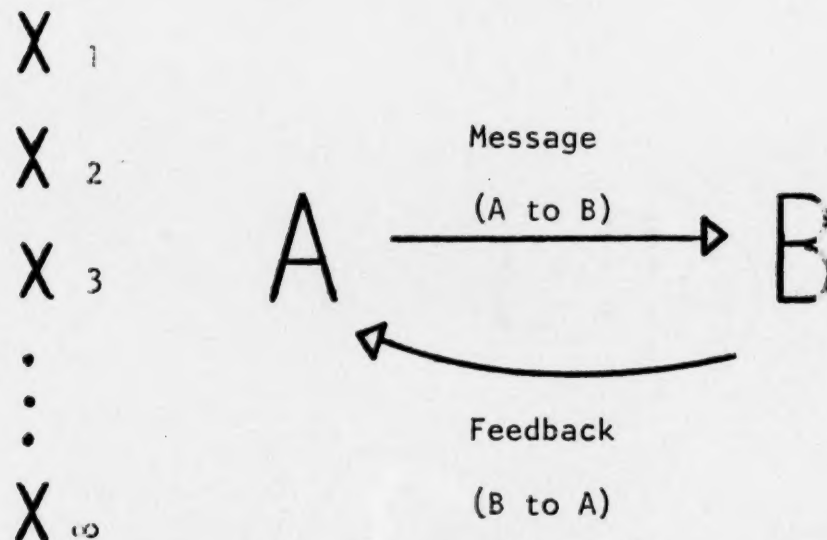


Figure 1. -- A model for communications research adapted from Westley and MacLean.¹

This notion of feedback is a concept that is crucial to the model.

In the first place it should be clear from the foregoing that it is feedback that assures the system character of the ABX... relationship. If A is to utilize his experience in influencing B, he must have information about any changes in the condition of B attributable to his communication.²

Research has been done which directly considers the problem of feedback from B to A.

Our problem deals with only one of the many relevant variables, the problem of feedback. The question becomes: How is the transmission of information from A to B influenced by the return of information from B to A?...But when the human being (A) seeks to transmit information to another human being (B), A's own sensory system is hardly an adequate source of

¹Bruce H. Westley and Malcolm S. MacLean, Jr., "A Conceptual Model for Communications Research," in Interpersonal Communication: Survey and Studies, ed. by Dean Barnlund (Boston: Houghton Mifflin Co., 1968), p. 47.

²Westley, "A Conceptual Model," p. 52.

information unless B takes some action which will help A to keep informed of A's own progress.¹

One experiment done with the effects of feedback on communication involved having an instructor describe geometric patterns to students in an effort to have the students recreate these geometric patterns. The experiment was done under four conditions of feedback:

1. Zero feedback in which instructors were hidden from the students and no questions or noises were permitted from the students.
2. Instructor and student could see one another, but no speaking by students was allowed.
3. The students and instructor could see one another, and the student was permitted to give a yes or no response to questions from the instructor.
4. Instructor and students were permitted to ask questions, interrupt, and in generally freely verbally interact.

The following conclusions were drawn by the authors of the experiment:

To summarize, we found that, within narrow limits: 1. A completion of the circuit between sender and receiver (feedback) increases the accuracy with which information is transmitted. 2. Feedback also increases receiver and sender confidence in what they have accomplished. 3. The cost of feedback is time. But the difference in time between free feedback and zero feedback appears to decrease. 4. A sender and a receiver can improve without what we have defined as feedback experience. 5. Free feedback experience improves subsequent zero feedback trials measurably. 6. Sender experience contributes more than receiver experience to improved accuracy of communications. 7. Zero feedback engenders some hostility in the receiver that becomes clearly perceptible when the situation changes from zero to free feedback. This hostility is short lived, lasting through only one or two free feedback trials. 8. Zero feedback engenders doubt in the sender.²

¹Harold J. Leavitt and Ronald A. H. Mueller, "Some Effects of Feedback on Communications," in Interpersonal Communication: Survey and Studies, ed. by Dean C. Barnlund (Boston: Houghton Mifflin Co., 1968), p. 251.

²Ibid., p. 259.

Applied to the teaching situation this model and research supports the idea that if the teacher (A) can receive feedback from the students (B), then the teacher can revise, extend, or otherwise modify his communicative behavior so as to increase the accuracy of his communication. In a large class situation it is claimed that a student response system can provide this feedback link.

Stimulus-Response Learning Theory

Bigge, in his review of the major learning theories, divides the stimulus-response theorists into four basic groups which he says are represented by "[Edwin R.] Guthrie's contiguous conditioning, [Clark L.] Hull's deductive behaviorism or reinforcement theory, [B. F.] Skinner's operant conditioning, and [Kenneth W.] Spence's quantitative S-R theory."¹

All of these theories, except Guthrie's, rely on some form of instrumental conditioning or reinforcement to accomplish learning. This instrumental conditioning or reinforcement includes the concept of feedback essentially the same as in communication theory. As defined by Bigge:

Instrumental conditioning usually is equated with reinforcement; it is response modification or change.⁹ An animal first makes a response, then receives a "reward"; the response is instrumental in bringing about its reinforcement. There is a feedback from the "rewarding" stimulus which follows the response that the organism is learning; a dog is fed after he "speaks" and, thereby, the likelihood of his "speaking" in the future is increased.

⁹Spence's learning theory does not treat instrumental conditioning as synonymous with reinforcement. See Chapter 6, pages 160-165.²

¹Morris L. Bigge, Learning Theories for Teachers (New York: Harper and Row, Publishers, 1964), p. 98.

²Ibid., p. 259.

Gagne has attempted to combine variants of the stimulus-response theory into a coherent approach to the educational process in order to design better education. In discussing feedback from learning, Gagne said, "According to a considerable body of evidence...feedback from the execution of desired responses in stimulus-response learning needs to occur within a few seconds if learning is to progress rapidly."¹ He went on to say, "The usefulness of frequent feedback during the acquisition of rules, or a set of interrelated rules, should not be overlooked. The designers of programmed instruction frequently point to the importance of confirming responses each step of the way."² Although these comments about feedback are directed to the learner, the same comments can be directed toward the instructor in his role of trying to determine whether his communication has been successful.

The presence of the students acts as a stimulus to which the instructor responds by attempting to provide instruction. He measures the success of this response by the feedback that he is able to receive from the class. This feedback must be as immediate as possible if future instructor responses to the student stimulus are to be effective. In addition to the benefit of immediacy of response, research has indicated that the knowledge of both the correctness and incorrectness of a particular behavior is the most effective feedback.³ The student response system can

¹Gagne, The Conditions of Learning, p. 259.

²Loc. cit.

³A. A. Lumsdaine, "Instruments and Media of Instruction," in Handbook of Research on Teaching, ed. by N. L. Gage (Chicago: Rand McNally and Co., 1963), p. 619.

be used to provide immediate knowledge to the instructor of the effectiveness of his teaching behavior.

The Student Response System: Use

The declared advantage of the electronic student response system lies in its ability to provide the instructor, directly and immediately, with summarized and quantified knowledge of student responses to questions based on his instruction. In traditional classes, an instructor knows how his students are doing only after he has given them some sort of test. This knowledge of the students' performance is available only days or weeks after the instructor's presentation. The student response system allows this feedback to happen systematically and immediately.

The student response system can be used in many ways. The first is to use the system to elicit responses to multiple-choice questions during the presentation of a lecture. The questions can be designed to test the students' understanding of facts, concepts, etc., just presented. The wrong choices listed, if carefully developed, can be used to provide clues as to exactly what kinds of mistakes the students are making or exactly what their misunderstandings are. In a test on mathematics one of the choices might be an answer obtained by dividing instead of multiplying. Thus the wrong response would pinpoint the nature of the error in understanding.

A second way to use the student response system is to instruct the students to responding according to a given code continually during the presentation. The code would allow them to indicate how well they felt they were understanding the material being presented. An elaborate code of this type might be:

- A. I am understanding, but you are going too slow and I am bored.
I already know this material.

- B. I am understanding, but you could go a little faster.
- C. I am understanding and you are proceeding at the right pace.
- D. I do not quite understand. Perhaps you are going too fast.
- E. You have lost me completely.

A less elaborate code might ask for only one of two responses:

- A. I understand.
- B. I do not understand.

The instructor could continually watch the percentage of responses in each category as displayed on the instructor console and adjust his presentation accordingly.

In matters of opinion where factual answers are not appropriate, the response system can be used to take intermittent or continuous polls of the students' opinions or feelings. The instructor could poll the class with questions designed to reveal their political biases, religious beliefs, value systems, etc. This information could be used in determining the tenor, direction, or orientation of his presentation. If an instructor wanted a class to understand the liberal point of view of a political issue, knowledge of the political leanings of his class could help him design the most appropriate educational strategy. He surely would not want to take the same tack with a conservative class as he might take with a liberal class.

As he gets feedback from the class, the instructor should be able to adjust his subsequent presentation to fit the needs of the class. In order to obtain maximum use of this immediate student response, an instructor will ideally change his behavior while the class is in session. This change in behavior on the part of the instructor should be perceivable by the student and at its optimum lead to a higher level of student achievement.

The Student Response System: Research

The forerunner of present electronic student response systems was the Classroom Communicator designed and used in 1950 to obtain viewer reaction to military training films. Research involving the Classroom Communicator established that students could accurately and reliably indicate their level of comprehension during a film presentation.¹

Since 1950, the student response system has evolved into a device which can provide immediate knowledge of the correctness of a response to the instructor. Several investigators and instructors have reported benefits to the students arising from the instructor's knowledge of the students' in-class level of comprehension. Reporting on the system in use at Syracuse University, Muller stated:

The system is based on the premise that feedback to a teacher about students' comprehension of his material while it is being presented would allow an instructor to modify his behavior in response to student reactions.²

In a review of the literature involving student response systems of many kinds and covering the years 1950 through 1962, Froelich stated:

Since the instructor receives feedback also, he knows whether his class is keeping up with him. Instead of calling on one or two students who have their hands raised to answer a question, as is done in the conventional lecture group, he may now get knowledge of results from the entire group.³

¹Herbert P. Froehlich, "What About Classroom Communicators?" Audio Visual Communication Review XI (May, 1963), p. 19-26.

²Richard L. Muller, "Student Responses in Lecture Instruction," Audio Visual Instructor XI (February, 1966), p. 94-5.

³Froelich, "What About Classroom Communicators?" p. 24.

Bridgeman, describing subsequent research at the University of California School of Medicine, reported that an instructor using a lecture response system could sense the needs of the class and adjust his presentation accordingly.¹

Research inquiring into student response systems as the source of feedback to an instructor during the presentation of his lecture has involved instruments of various kinds and design. To start with a very simple design, a recent experiment had the members of an audience indicate their agreement, neutrality, or disagreement with speakers by holding up various colored cards. The speakers were beginning students in a public speaking class and the audience were the rest of the students in the class. The experiment utilized secret instructions to members of the audience as to the feedback given to the speaker. Favorable audience feedback helped the speaker, while unfavorable audience feedback seemed to result in a deterioration of delivery as determined by ratings of speech teachers.²

McNeil used a device to give feedback to student teachers by means of four differently colored lights. Ten student teachers were used and a questionnaire containing twenty-one items of appropriate teaching procedures was administered to the students in the classes at the beginning and end of a five-week period. The score on the twenty-one items was used as the measure, and correlations between the beginning and end of the five-week period were calculated. One group was taught using a lecture presentation

¹Charles Bridgeman, "A Lecture Response Device: A Preliminary Report on a Key Aspect of a Coordinated Teaching Program in Anatomy," Journal of Medical Education (February, 1964).

²T. T. Amato and T. H. Ostermeier, "Effect of Audience Feedback on the Beginning Public Speaker," Speech Teacher XVI (January, 1967), pp. 55-60.

with interspersed multiple-choice questions designed to measure the students' comprehension of the lecture presentation; the second group was presented with the questions but no answer was required of them on the feedback device. The third group was given only the pre- and post-tests. No analysis of variance was made, but McNeil concluded that correlations of evaluation means for each group between teacher practices at the beginning and end of the study indicated that there was no significant change with respect to teaching behavior in either the control or experimental groups. However, on a second evaluative questionnaire the pupils indicated that they felt under obligation to listen more intently, they felt that the teachers knew more about the pupils, and that they learned more because of the student response system.¹

A comparison of an electronic student response system with a simple display of colored cards in answer to an instructor's questions during the presentation indicated the superiority of the electronic system.² The instructor's comments were to be varied to correspond with the feedback information thus received. The study concluded that students using the electronic response system achieved higher scores than students using the colored card response. The difference was significant for the end of the

¹John McNeil, "An Experimental Effort to Improve Instruction Through Visual Feedback," The Journal of Educational Research, CV (March, 1962), pp. 283-5.

²Martha W. Bradley, "A Comparison of Student Achievement in Experimental Classrooms with Visual Display of Verbal Stimuli and an Electronic of Mechanical Student Response System." (Unpublished Ph. D. Dissertation, Syracuse University, 1968).

semester evaluation instrument. It would seem that the information received through the electronic system modified the instructor's behavior to the benefit of the students more effectively than did a simple display of colored cards.

Phillips described an unpublished study by Steve Nelson at Mount San Jacinto College. Having used the student response system, Nelson then gave his students a questionnaire in which he asked them to indicate their perception of the extent to which the use of the student response system had increased their interest in and understanding of the subject matter and their involvement and participation in the class activities. The results of the questionnaire indicated that:

...student interest was increased in 73 percent of the students while 77 percent felt an increased involvement. An increase in participation was felt by 68 percent of the students, and 78 percent indicated that their understanding of the subject matter had also increased.¹

When a student response system is used as a testing device rather than a feedback device, some difficulty has been reported. Crane, reporting research conducted at the University of Michigan using a device involving only true-false responses, reported that when the questions which elicited the student responses were used for grading, the practice produced tension and interfered with rapport.²

¹Peyton H. Phillips, "The Instant Student Response System with Emphasis on Mount San Jacinto College," (unpublished seminar paper, University of California at Los Angeles, 1968), p. 20.

²H. R. Crane, "An Experiment Toward Establishing Communication from Audience to Lecturer," in An Abstract of Pertinent Research Related to EDEX Educational Systems, by EDEX Corporation (Mountain View, California, n.d.), p. 10.

In an experiment related to the use of a student response system to provide immediate feedback, instructors were allowed to view video tapes of their teaching presentation while simultaneously viewing a frequency distribution on a five-point scale of teaching effectiveness presented by an array of lighted lamps. The instructor could determine at any point in his presentation what the students thought of the presentation. The experiment was also repeated with peer evaluations of teaching performances instead of student evaluation of teaching performance. Correlations between peer and student ratings ranged from .47 to .78 indicating that the students could rate teaching performance at least as well as other teachers. The teacher gaining this feedback through the program analyzer initially lost in teaching effectiveness, but gained it back by the third session of the treatment period. The duration of the experiment was insufficient to determine whether instructors would then have moved ahead of their original position on the rating scale.¹

These studies suggest that feedback of information by an electronic student response system to the instructor results in a higher level of student comprehension and achievement. In these studies, however, the effect of student feedback to the instructor was not clearly separated from the effect of instructor feedback to the student. If feedback to the student of the correctness of his response is the primary advantage of the student response system, much less expensive devices can achieve that same

¹F. Craig Johnson and others, "Investigation of Motion Picture Film and the Program Analyzer Feedback to Improve Television Teacher Training," Speech Monographs XXX (November, 1963), pp. 373-6.

advantage. At least three investigators have found simple punchcard devices to be effective in providing knowledge of results feedback to students.¹

On the other hand, if student feedback to the instructor is an important factor, and if feedback is just as effective when obtained outside of class and some time later, many kinds of test scoring devices give an instructor knowledge of the students' responses soon after the end of a class period. The student response system provides the potentially significant advantages of immediate feedback about the accuracy of the students' responses to questions and continuous feedback about the students' felt level of comprehension.

Statement of the Problem

Problem

An important unanswered question is whether the instructor can use this feedback effectively to change his teaching behavior during his presentation to the class in such a way that the students perceive more effective "teaching" and are thereby able to understand and achieve at higher levels of proficiency. The questions may be specifically stated in two parts as follows:

¹G. W. Angell, "Effect of Immediate Knowledge of Quiz Results on Final Examination Scores in Freshman Chemistry," in Journal of Educational Research, XLII (January, 1949), pp. 391-4; Robert T. Gray, An Evaluation of the Effect of Immediate Feedback Device Used with Typical College Classroom Tests, Report of the Bureau of Research, Office of Education, Department of Health, Education, and Welfare (Washington, D.C., Government Printing Office, 1967); S. L. Pressey, "Development and Appraisal of Devices Providing Immediate Scoring of Objective Tests and Concomitant Self Instruction," in Teaching Machines and Programmed Learning, ed. by A. A. Lumsdaine and Robert Glaser (Washington, D.C.: National Education Association, 1970) pp. 69-88.

1. Will students rate an instructor more favorably on qualities related to his classroom teaching behavior when he receives in-class feedback through a student response system than when he does not receive this feedback?

2. Will the achievement of students on examinations of the subject matter of the course be higher for the class in which the instructor is receiving in-class feedback through the student response system than for the class in which he is not receiving this feedback?

Hypotheses

I. Students will rate an instructor more favorably on qualities related to his classroom teaching behavior when he receives in-class feedback through a student response system than when he does not receive this feedback. The specific qualities are:

1. Organization of Course
2. Preparation for Each Class
3. Teaching Skill
4. Enthusiasm and Interest in Course
5. Class Discussion and Questions
6. Poise and Self-Confidence
7. Ability to Create Student Interest
8. Classroom Management and Discipline
9. Relationship between Students and Instructor

II. The achievement of students on examinations of the subject matter of the course will be higher for the class in which the instructor

is receiving in-class feedback through the student response system than for the class in which he is not receiving this feedback.

Delimitations and Definitions

These hypotheses assume that the instructor is using a lecture method with a large enough class that no significant verbal interaction with the class members during the class is possible. His only source of in-class feedback is that presented to him by the student response system. It is also assumed that the instructor does not elicit feedback from that class in which he does not receive feedback through the student response system.

The feedback that the instructor receives is defined as the pattern of lights on the instructor display panel which is presented as a result of the multiple-choice questions asked by the instructor and the student comprehension code. The type of questions used and the student comprehension code are described more completely in Chapter II.

The qualities related to classroom teaching behavior are the qualities listed on the rating scale used in this investigation.¹ The items of special interest are those which seem to be most related to classroom teaching behavior and are listed in the first hypothesis above.

The rating scale is arranged so that a low number represents a more favorable rating. The rating of the instructor for the class is defined as the arithmetic mean of the ratings given by the students present in the class when the rating form is given. The achievement of students will be measured using the tests constructed by the instructor of the course.

¹The complete rating scale is reproduced in Appendix B.

The student response system is the one manufactured by Response Systems Corporation.

CHAPTER II

RESEARCH METHODOLOGY

Research Hypotheses

Both theoretical and experimental studies have suggested that the reception of feedback from students by an instructor through a student response system would result in a significant improvement in the instructor's classroom behavior. Moreover, these studies have suggested that this change in teaching behavior would result in significantly higher scores on subject matter tests for those students in classes in which the instructor was receiving feedback. The specific hypotheses which were investigated in this experiment are as follows:

1. Students will rate an instructor more favorably on qualities related to his classroom teaching behavior when he receives in-class feedback through a student response system than when he does not receive this feedback. The specific qualities are:

1. Organization of Course
2. Preparation for Each Class
3. Teaching Skill
4. Enthusiasm and Interest in Course
5. Class Discussion and Questions
6. Poise and Self-Confidence
7. Ability to Create Student Interest
8. Classroom Management and Discipline
9. Relationship between Students and Instructor

11. The measured achievement of students obtained from examinations of the subject matter of the course will be higher for the class in which the instructor is receiving in-class feedback through the student response system than for the class in which he is not receiving this feedback.

Subjects

The subjects of the study were four full-time instructors teaching at Mt. Hood Community College, Gresham, Oregon. Each instructor was teaching two sections of the same subject as part of his regular class load. The subjects were economics, chemistry, physical science, and anthropology. These particular instructors were chosen because they had two sections of the same subject, the times of the classes did not conflict with one another so that they could all be scheduled into the room equipped with the student response system, and they agreed to participate in the study. They were all men and were experienced college instructors. All but the anthropology instructor had taught previously in high schools.

Experimental Conditions

The experiment was conducted using the RESYC Student Response System manufactured by Response Systems Corporation and installed in the planetarium classroom at Mt. Hood Community College.¹

The courses taught by the instructors selected for the experiment were part of the regular program of Mt. Hood Community College. The

¹See Appendix A for a description of the complete details of the system.

students did not know that they were participating in research evaluating the effectiveness of the response system in modifying the instructor's behavior. They were told that they were part of an experiment involving the student response system.

The students registered in the courses as part of the regular registration procedure and therefore were not randomly assigned to the sections. An attempt was made to measure any differences in the groups, however, before they moved into the experimental situation. The details are discussed in the following section on the experimental design. The courses were not scheduled to accommodate any particular group of students. There was no reason to believe that a particular group of students selected one of the sections in such a way as to create a substantial variation between sections. The students were generally transfer students rather than vocational technical students. These courses are designed for lower-division collegiate transfer students and are so approved by the Oregon State System of Higher Education. The courses met for ten weeks with an eleventh week for final exams. Each course was the second quarter portion of a sequence. The weekly schedule of each of the courses is given in Table 1.

Experimental Design

During the first five weeks of the quarter, the classes met in a conventional classroom and were taught in the instructor's accustomed manner. During the second five weeks, the classes met in the planetarium classroom which is equipped with the student response system. This change in rooms could potentially affect both the students' rating of the instructor and their achievement. The planetarium differed from the

TABLE 1
SCHEDULE OF CLASSES USED IN EXPERIMENT

Course	Section	Time	Day
Anthropology	1	8:00 A.M. - 8:50 A.M.	M W F
	2	10:35 A.M. - 11:50 A.M.	T Th
Economics	1	7:45 A.M. - 9:00 A.M.	T Th
	2	1:10 A.M. - 2:25 P.M.	T Th
Physical Science	1	10:00 A.M. - 10:50 A.M.	M W F
	2	11:00 A.M. - 11:50 A.M.	M W F
Chemistry	1	1:10 P.M. - 2:00 P.M.	M W F
	2	2:10 P.M. - 3:00 P.M.	M W F

conventional classroom and therefore the students' perceptions of the instructor's behavior as well as their own achievement could be affected by this different environment. This change, however, was the same for both the control and the experimental group and therefore was considered as affecting both groups in the same manner.

The instructor was asked to modify his instruction to use the student response system in the following manner. First the instructor was to prepare a few multiple-choice questions designed to measure how well the students were comprehending the material being presented in each class section. These questions were to be asked during the presentation with the students responding through the response system. Second, the instructor was asked to have the students continually monitor their perceived level

of comprehension by pressing the response keys according to the following instructions:

Please indicate how well you are comprehending the material being presented by depressing button A if you feel you are comprehending the material adequately, and depressing button B as soon as you feel you are not comprehending the material adequately.

In the control section, section one, the instructor had both the seating array and the percentage readout covered; thus he was denied feedback. In section two, the experimental section, the instructor received feedback though the seating array and the percentage readout. The earlier section of each course was picked as the control section since it was the section in which the instructor would not receive feedback. Therefore, his presentation in the second section would not be affected by the feedback from the first section. In both control and experimental sections, the instructor could print out the results and consult them between class meetings. This procedure was allowed since the purpose of the investigation was to measure the effect of in-class feedback. The time sequence of the investigation is diagrammed in Table 2.

TABLE 2
EXPERIMENTAL DESIGN

	First Five Weeks	Second Five Weeks
Control Section	Traditional instruction in regular classroom A	Student response system with no feedback B
Experimental Section	Traditional instruction in regular classroom Y	Student response system with feedback Z

A, B, Y, and Z indicate times that the rating scale was given.

Student Ratings of Instructor

Since only four subjects participated in the experiment, an attempt was made to determine to what extent the results of the student ratings could be generalized beyond these four subjects. If the teaching behavior of the instructors was considered as one factor and the feedback through the student response system was considered as the second factor of a factorial design, then the amount and statistical significance of the variance due to the interaction between these two factors could be determined. If this interaction was not significant, then differences between student ratings of instructors for experiment and control groups could be attributed to the student response system and not specifically to the interaction between a particular instructor and the student response system. The effect of the responses presented through the student response system would not depend on the instructor and any results found could be considered to apply to at least community college instructors using comparable teaching methods based primarily on the lecture.

This analysis of interaction was done on each of the items on the rating scale using Kirk's CRF-24 design.¹ The specific computational method used was that developed by Kirk for use when there are different numbers of observations for the treatment combinations. These different numbers in each treatment combination were due to absences, failure to mark a particular item, and the fact of different numbers of students enrolled in the various classes. Therefore an unweighted means analysis was used.²

¹Kirk, Roger E., Experimental Design Procedures for the Behavioral Sciences, (Belmont, California: Wadsworth Publishing Company, 1968), pp. 173-176.

²Ibid., pp. 202-203.

In addition to the interaction effects, the analysis of variance in the factorial design also yields information of the significance of the main effects. These main effects, however, must be investigated at each level of treatment if the interaction between treatments is significant. Therefore, the ratings of each instructor were analyzed separately.

Comparisons were made for the student rating of the instructor's teaching behavior for both the control and experimental groups between the first five-week rating and the second five-week rating. Comparisons were also made between the control and experimental groups at the end of the first five weeks and at the end of the second five weeks. Referring to Table 2, the null and alternate hypotheses were:

- | | |
|---------------------------------|---------------------------------|
| 1. $H_0: \bar{X}_A = \bar{X}_B$ | $H_1: \bar{X}_A \neq \bar{X}_B$ |
| 2. $H_0: \bar{X}_Y = \bar{X}_Z$ | $H_1: \bar{X}_Y \neq \bar{X}_Z$ |
| 3. $H_0: \bar{X}_A = \bar{X}_Y$ | $H_1: \bar{X}_A \neq \bar{X}_Y$ |
| 4. $H_0: \bar{X}_B = \bar{X}_Z$ | $H_1: \bar{X}_B \neq \bar{X}_Z$ |

Null hypothesis number one indicates whether there was any significant change in instructor behavior for the control group between the traditional treatment and the student response treatment with no feedback. A significant difference here would indicate that the student response system itself with no feedback to the instructor changes the students' rating of instructor behavior. Hypothesis number two would indicate the same sort of result for the experimental section. Hypothesis number three seeks to determine if there is any difference in the students' rating of the instructor between the experimental and control group before they moved into the experimental situation and actually serves as pretest for the

experimental situation. Hypothesis number four will indicate any significant differences that can be attributed to the effect of feedback from student to instructor. Differences between the control and experimental section at the end of the experiment would contain differences due to the effect of different sections, the student response system, and the feedback to the instructor. If hypothesis number three is not rejected and there is a significant difference between control and experimental sections at the end of the experiment, that difference can be attributed to the effect of receiving feedback from the students through the student response system.

An F-ratio in an analysis of variance was used to test the null hypotheses that in each case the student rating means were equal. The analysis of variance was that discussed by Kirk.¹ Since each null hypothesis involves only two treatments, the F ratio determines whether the means are significantly different at a given level of significance.

An analysis of covariance applied to the student ratings at the end of the second five weeks with the student ratings at the end of the first five weeks as the covariant would have been a more powerful way of detecting any significant differences. Such an analysis would have required that the students identify their rating forms in some way. In order that the students could be assured that their responses on the rating form would be completely anonymous, an analysis of covariance was not planned for the student rating form. Analysis of covariance was used on the student achievement measures.

¹Kirk, Experimental Design, p. 59. [The actual calculations were made through the use of the University of Washington Computer Facilities with program number BMD01V -- Analysis of Variance for One-Way Design -- Version of May 4, 1957.]

Student Achievement Measures

Student achievement was measured using the instructor-constructed tests regularly given by the instructors. The average score on the tests taken during the first five weeks was used as the measure of student achievement by midterm (points A and Y in Table 2). The average score on the tests taken during the second five weeks was used as the measure of student achievement by the end of the course (points B and Z in Table 2).

Comparison was made between the mean scores obtained by the experimental and control groups during the second five-week period. The null hypothesis tested was that there would be no differences in the average scores between the experimental and control group when those scores were adjusted for the variance in the scores obtained at the end of the first five weeks. This analysis of covariance was made using the computational method devised by Kirk for what he calls the "CRAC-K design."¹ The F ratio at the 0.05 level of significance was applied to the variance of the scores obtained during the second five-week period corrected by the variance obtained during the first five weeks.

The use of student achievement in an effort to measure changes in instructor behavior was potentially unreliable and invalid. Many factors, such as student motivation, outside influences, amount of student work outside of class, etc., would make it difficult to attribute changes in student achievement to the influence of the instructor. In this experiment the measurement of student achievement at the end of the first five

¹Kirk, Experimental Design, pp. 455-472.

weeks of the course did attempt to measure the other factors such as motivation, degree of application, etc. If these factors continue to the second half of the quarter as they were in the first half of the course, differences in student achievement between the two classes can be attributed to the change in instructor behavior brought about by feedback from students to the instructor through the student response system.

This experimental design actually used the students as a measuring device for the instructor-subject. The students were not randomly placed in the control and experimental sections and therefore it might be argued that their ratings would not be those of a randomly-selected group of students which could be considered representative of community college students in the lower-division collegiate transfer program. However, as Campbell and Stanley pointed out in discussing the quasi-experimental design which they call the nonequivalent control group design.

An effort to explain away a pretest-posttest gain specific to the experimental group in terms of such extraneous factors as history, maturation, or testing must hypothesize an interaction between these variables and the specific selection differences that distinguish between the experimental and control groups.¹

No selection factor appeared to be operating in the registration procedure which would make a difference in the groups with regard to their reactions to a student response system.

As far as the interaction between the student and the student response system was concerned, both experimental and control sections were the same. In both of the sections, the instructor was using the student

¹Donald T. Campbell and Julian C. Stanley, "Experimental and Quasi-Experimental Designs for Research on Teaching," in Handbook of Research on Teaching, ed. by N. L. Gage (Chicago: Rand McNally and Co., 1963) p. 218.

response system, and the students were obtaining reinforcement for correct responses. The fact that the instructor was being denied feedback in the control section and had access to feedback in the experimental section was not readily apparent to the students.

Research Instruments

Student Ratings of Instructor

The first research hypothesis predicts a favorable change in qualities related to the classroom teaching behavior of the instructor as rated by the students. This change was measured by using A Student's Rating Scale of an Instructor.¹ This scale was developed to allow students to rate an instructor on qualities related to both his teaching behavior and his personal characteristics.

This scale has seventeen items to be rated on a nine-point Likert scale for each item. The items are:

1. Organization of Course
2. Preparation for Each Class
3. Teaching Skill
4. Enthusiasm and Interest in Course
5. Assignments
6. Judgment of Values
7. Class Discussion and Questions
8. Poise and Self-Confidence
9. Examinations

¹See Appendix B for a reproduction of this rating scale.

10. Scholarship
11. Ability to Create Student Interest
12. Classroom Management and Discipline
13. Speech
14. Tolerance
15. Sense of Humor
16. Personal Appearance
17. Relationship Between Students and Instructor

The nine-point scale used to evaluate each of these items is subdivided into three groups by qualifying phrases which further define the item. The student may, therefore, first pick the group and then further refine his reaction on a three-point scale within that group. A rating of one is the most favorable rating and a rating of nine is the least favorable rating. Each of the seventeen items was considered separately in the statistical analysis as a possible measure of change in instructor behavior as perceived by the students. The qualifying phrases on the nine-point scale for each of the items give considerable face validity to the item. Especially items 1, 2, 3, 4, 7, 8, 11, 12, and 17 might be expected to change as a result of feedback from students to instructor.

This particular rating scale was chosen primarily because the items to be rated are all directly related to an instructor's behavior. Although the items are short, descriptive phrases listed on the scale defined the instructor behavior to be rated. Other rating scales reviewed were a combination of instructor behavior and characteristics of the course such as texts, grading practices, etc. The rating scale contained both items of instructor behavior which could be expected to change and other items of instructor behavior which were not expected to change as a result

of the experimental treatment. These latter items would provide a check on the reliability of the rating scale over time, in addition to the reliability study done on another instructor.

The author of the rating scale does not provide any validity or reliability data. The rating scale was administered to a psychology class to obtain a measure of the reliability. Each item on the rating scale was considered separately, and only one form was used. Therefore, only the reliability of the scores over time needed to be measured. The rating scale was administered at the end five weeks and again at the end of ten weeks. The product-moment correlation coefficient between these two sets of scores was determined for each item.¹

The items specifically mentioned in the research hypothesis had correlations ranging from 0.30 to 0.79. Only one item, Personal Appearance, had a correlation less than 0.30. All other items had correlations of 0.30 and above with eight of the items having correlations of 0.60 or above.

In addition, an analysis of variance was done for each item and none showed any significant difference between the midterm and final administration of the scale.

The rating scale was also administered to a section of economics taught by the economics instructor who participated in the experiment. This section did not participate in the experiment itself. The rating scale was administered after five weeks and ten weeks of instruction. An analysis of variance was done for each question and only two showed any

¹See Appendix C, Table 1.

significant difference between the midterm and final administration of the rating scale.¹ These two were items three (Teaching Skill) and five (Assignments). Item five (Assignments) was not of special interest in this experiment. The change over time of item three (Teaching Skill) will be considered in the analysis of the results in Chapter IV.

Student Achievement Measures

The second research hypothesis predicted that student achievement would be increased in those classes in which the instructor received feedback from the students. The student achievement was measured using the tests developed by the instructors for grading their students. All students were included except those for whom no scores were recorded for one of the two periods because of withdrawal from the course or absence from the class.

For the economics class two tests were averaged for the first five weeks and four tests for the second five weeks. Scores were used for 41 out of 48 in the control group and 38 out of 53 in the experimental group.

The anthropology instructor gave two tests during the first five weeks and one test during the second five weeks. Scores were used for 32 out of 37 in the control group and 31 out of 38 in the experimental group.

For the physical science class three tests were averaged for both the first and second five weeks. The control group used 70 out of 74 scores and the experimental group, 66 out of 71.

Only a mid-term and a final examination were given in the chemistry class. Scores were used for 51 out of 56 in the control group and 30 out

¹See Appendix C, Table 2.

TABLE 3
ANALYSIS OF INTERACTION FOR
STUDENT RATINGS AT END OF COURSE

ITEM	INTERACTION F-RATIO	SRS MAIN EFFECT F-RATIO
1. Organization of Course ^c	1.90	2.51
2. Preparation for Each Class ^c	1.16	0.53
3. Teaching Skill ^c	2.92 ^a	13.97 ^b
4. Enthusiasm and Interest in Course ^c	1.64	5.89 ^b
5. Assignments	3.02 ^a	4.12 ^b
6. Judgment of Values	1.56	0.82
7. Class Discussion and Questions ^c	0.61	0.65
8. Poise and Self-Confidence ^c	7.04 ^a	4.13 ^b
9. Examinations	0.04	1.52
10. Scholarship	3.76 ^a	0.36
11. Ability to Create Student Interest ^c	0.14	2.09
12. Classroom Management and Discipline ^c	1.28	1.14
13. Speech	4.16 ^a	3.33
14. Tolerance	2.97 ^a	0.37
15. Sense of Humor	3.18 ^a	5.59 ^b
16. Personal Appearance	2.65 ^a	4.69 ^b
17. Relationships Between Students and Instructor ^c	2.74 ^a	0.82

^aCritical F ratio is 2.65 at 0.05 level of significance.

^bCritical F ratio is 3.89 at 0.05 level of significance.

^cQualities listed in first research hypothesis.

for all four instructors analyzed as a group instead of separately. The results of this analysis are presented in Table 3. Of the nine qualities listed in the first hypothesis, three showed a significant difference at the 0.05 level of significance. These three were Teaching Skill, Enthusiasm and Interest in Course, and Poise and Self-Confidence. However, only the item Enthusiasm and Interest in Course did not also show a significant interaction. The presence of this interaction supports the necessity of considering each instructor separately. The significant interaction for other items does not give a clear indication for or against the possibility of generalizing the results to other community college instructors using comparable teaching methods. This point will be discussed further in the next chapter which contains the conclusions drawn from the results reported in this chapter.

Economics Instructor

Student Ratings

The results of the comparisons of student ratings for the economics instructor are summarized in Table 4. Pattern A, supportive of the first hypothesis, was obtained on eleven of the seventeen items on the questionnaire. Of the nine qualities specifically listed in the first hypothesis, five showed pattern A. These were Organization of Course, Preparation for each Class, Teaching Skill, Enthusiasm and Interest in Course, and Classroom Management and Discipline. The other items on the questionnaire which showed pattern A were Assignments, Judgment of Values, Examinations, Scholarship, Speech, and Sense of Humor.

TABLE 4

COMPARISONS OF STUDENT RATINGS OF THE ECONOMICS INSTRUCTOR

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL ^a				DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL ^b			
	FOR CONTROL		FOR EXPERIMENTAL		AT MIDTERM		AT FINAL	
	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO
1. Organization of Course ^d	- .07	.04	.94	6.56 ^c	- .88	5.71 ^c	.13	.14
2. Preparation for Each Class ^d	- .16	.26	.98	9.04 ^c	- .68	3.49	.46	2.57
3. Teaching Skill ^d	.19	.18	1.61	16.13 ^c	- .41	.75	1.01	7.07 ^c
4. Enthusiasm and Interest in Course ^d	.11	.09	1.03	8.35 ^c	- .32	.64	.60	3.55
5. Assignments	- .24	.36	.49	1.35	-1.17	7.65 ^c	- .43	1.09
6. Judgment of Values	- .09	.08	.58	4.02 ^c	- .31	.90	.36	1.61
7. Class Discussion and Questions ^d	- .05	.03	.74	3.43	- .61	2.51	.18	.24
8. Poise and Self Confidenced	- .37	1.65	.36	1.67	- .47	2.50	.26	.91
9. Examinations	- .38	1.70	.77	7.22 ^c	- .70	5.13 ^c	.45	2.72
10. Scholarship	- .08	.12	.60	5.29 ^c	- .46	2.73	.22	.88
11. Ability to Create Student Interest ^d	- .25	.38	.84	3.62	- .25	.31	.34	.63
12. Classroom Management and Disciplined	- .13	.28	.46	2.60	- .65	5.31 ^c	- .06	.06

TABLE 4--Continued

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL		DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL					
	FOR CONTROL		FOR EXPERIMENTAL		AT MIDTERM		AT FINAL	
	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO
13. Speech	- .53	1.93	.86	7.80 ^c	- .33	.84	1.06	11.17 ^c
14. Tolerance	.08	.14	.42	2.78	- .36	1.82	- .02	.01
15. Sense of Humor	- .07	.04	.77	4.82 ^c	- .26	.41	.58	3.38
16. Personal Appearance	.00	.00	.39	2.57	- .33	1.44	.05	.07
17. Relationship Between Students and Instructord	.22	.77	.28	1.05	- .35	1.71	- .29	1.20

^adifference was obtained by subtracting the mean rating at final from the mean rating at midterm. A positive difference indicates a change to a more favorable rating at the final rating.

^bdifference was obtained by subtracting the mean rating of the experimental group from the mean rating of the control group. A positive difference indicates a more favorable rating by the experimental group.

^cThe critical ratio is 3.98 for the 0.05 level of significance.

^dQualities listed in first research hypothesis.

The items Teaching Skill and Speech showed a positive difference between midterm and final for the experimental group with no significant change for the control group resulting in a significant positive difference between experimental and control groups at the final rating. On the four items Organization of Course, Assignments, Examinations, and Classroom Management and Discipline, there was a significant negative difference between experimental and control group at midterm. The control group showed no significant change between midterm and final ratings but the experimental group had sufficient positive increase in rating to overcome the previous negative difference, resulting in no significant difference at the final rating. On the items Preparation for Each Class, Enthusiasm and Interest in the Course, Judgment of Values, Scholarship, and Sense of Humor, there is a significant positive difference in the midterm and final ratings for the experimental group. However, this difference is not enough to show up as a significant difference in rating between the experimental and control groups on the final ratings.

Since this instructor had an administration of the student rating instrument for a class not participating in the experiment, it is important to note that in the section which was taught in a traditional way for the entire quarter there was no significant difference between the midterm and final ratings on fifteen of the seventeen items. The two items (Teaching Skill and Assignments) for which there was a significant difference both show a difference in the negative direction. In the experimental situation these items followed pattern A and indicated a significant difference in the positive direction.

Student Achievement

The results of the comparison of student achievement scores for the economics instructor are summarized in Table 5. The null hypothesis cannot be rejected. For this instructor the use of the student response system during the last five weeks of the course produced no significant difference in the scores of the students on the instructor's tests, even when adjusted for any possible difference during the first five weeks of the course.

TABLE 5
COMPARISON OF STUDENT ACHIEVEMENT SCORES
FOR ECONOMICS INSTRUCTOR

Item	First Five-Week Period			Second Five-Week Period		
	N	M	SD	N	M	SD
Experimental	38	180.7	37.8	38	79.8	9.12
Control	41	177.1	38.9	41	78.7	12.3
Difference		3.6			1.1	
F ratio ^a					0.27	

^aDetermined from an analysis of covariance with the first five-week scores as the covariant. The critical F ratio is 3.97 for the 0.05 level of significance.

Chemistry Instructor

Student Ratings

The results of the student ratings for the chemistry instructor are summarized in Table 6. Pattern A, supportive of the first hypothesis, was

TABLE 6--Continued

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL		DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL	
	FOR CONTROL		AT MIDTERM	
	DIFF	F-RATIO	DIFF	F-RATIO
13. Speech	- .45	2.39	- .12	.14
14. Tolerance	.62	1.90	- .93	2.66
15. Sense of Humor	.18	.20	- .54	1.02
16. Personal Appearance	- .11	.08	.34	.51
17. Relationship Between Students and Instructor ^d	.26	.55	- .68	1.75
			.72	4.96 ^c
			- .09	.04
			.19	.25
			.81	6.89 ^c
			.51	1.97

^aifference was obtained by subtracting the mean rating at final from the mean rating at midterm. A positive difference indicates a change to a more favorable rating at the final rating.

^bifference was obtained by subtracting the mean rating of the experimental group from the mean rating of the control group. A positive difference indicates a more favorable rating by the experimental group

^cThe critical ratio is 4.08 for the 0.05 level of significance.

^dqualities listed in first research hypothesis.

obtained for six of the seventeen questionnaire items. Of the nine qualities specifically mentioned in the first hypothesis, three showed pattern A. These were Teaching Skill, Poise and Self-Confidence, and Relationship between Students and Instructor. Other items of the questionnaire which showed pattern A were Speech, Tolerance, and Personal Appearance.

Pattern B, somewhat supportive of the first hypothesis, was obtained for two of the questionnaire items. These were Organization of Course, and Scholarship. The first of these items is one of the nine qualities specifically mentioned in the first hypothesis; the second is not.

Significant positive differences between the final ratings of the control and experimental groups were found on the items of Teaching Skill, Speech, and Personal Appearance, primarily due to a positive increase in rating for the experimental group between midterm and final ratings, since there was no significant difference between the control and experimental groups on the midterm ratings. The items Poise and Self-Confidence, Tolerance, and Relationship between Students and Instructor showed a significant positive difference between the midterm and final rating of the experimental group. There was no significant difference between the control and experimental groups at the final rating but, since there was a negative difference between the groups at midterm, the final lack of significant difference between the groups represents an increase in the experimental group ratings up to the level of the control group ratings.

The items Organization of Course, and Scholarship, showed a significant positive difference between the experimental and control groups at the final ratings but this resulted primarily from a negative difference between the midterm and final ratings of the control group and not from a change in the experimental group.

Student Achievement

The results of the comparison of student achievement scores for the chemistry instructor are summarized in Table 7. The null hypothesis cannot be rejected. For this instructor, the use of the student response system during the last five weeks of the course produced no significant difference in the scores of the students on the instructor's tests even when adjusted for any possible difference during the first five weeks of the course.

TABLE 7
COMPARISON OF STUDENT ACHIEVEMENT SCORES
FOR CHEMISTRY INSTRUCTOR

Item	First Five-Week Period			Second Five-Week Period		
	N	M	SD	N	M	SD
Experimental	30	34.7	10.8	30	49.6	18.0
Control	51	35.9	9.0	51	49.9	12.7
Difference	- 1.2			- 0.3		
F ratio ^a	1.32					

^aDetermined from an analysis of covariance with the first five-week scores as the covariant. The critical F ratio is 3.97 for the 0.05 level of significance.

Physical Science Instructor

Student Ratings

The results of the student ratings of the physical science instructor are summarized in Table 8. One questionnaire item, Organization of Course,

TABLE 8

COMPARISON OF STUDENT RATINGS OF THE PHYSICAL SCIENCE INSTRUCTOR

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL ^a		DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL ^b	
	FOR CONTROL		AT MIDTERM	
	DIFF	F-RATIO	DIFF	F-RATIO
1. Organization of Course	.21	1.15	-.19	.69
2. Preparation for Each Class	.28	1.88	-.13	.36
3. Teaching Skill	.35	2.91	.02	.01
4. Enthusiasm and Interest in Course	.36	3.58	-.04	.04
5. Assignments	.22	.87	.31	1.78
6. Judgment of Values	.18	1.24	-.33	3.56
7. Class Discussion and Questions	.17	.47	.22	.82
8. Poise and Self Confidenced	.29	4.06 ^c	-.36	3.50
9. Examinations	-.10	.13	.00	.00
10. Scholarship	.12	.44	-.58	9.44 ^c
11. Ability to Create Student Interest	.39	3.83	.00	.00
12. Classroom Management and Disciplined	.24	1.52	-.04	.04
			-.09	.21
			-.41	5.03 ^c
			-.39	4.40 ^c
			-.67	13.75 ^c
			-.08	.07

TABLE 8 -Continued

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL		DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL	
	FOR CONTROL		AT MIDTERM	
	DIFF	F-RATIO	DIFF	F-RATIO
13. Speech	.14	1.10	- .08	.19
14. Tolerance	.41	4.02 ^c	.09	.12
15. Sense of Humor	.07	1.17	- .26	2.71
16. Personal Appearance	.07	.22	- .06	.16
17. Relationship Between Students and Instructors	.24	2.51	.03	.02
			- .04	.10
			- .44	3.81
			- .20	4.71 ^c
			- .04	.09
			- .24	2.72

^aDifference was obtained by subtracting the mean rating at final from the mean rating at midterm. A positive difference indicates a change to a more favorable rating at the final rating.

^bDifference was obtained by subtracting the mean rating of the experimental group from the mean rating of the control group. A positive difference indicates a more favorable rating by the experimental group.

^cThe critical ratio is 3.97 for the 0.05 level of significance.

^dQualities listed in first research hypothesis.

showed pattern A, supportive of the first hypothesis, and is one of the nine qualities specifically mentioned in the hypothesis. On this item a negative difference between the experimental and the control group at the midterm rating was overcome by a significant positive difference in rating for the experimental group between the midterm and final ratings resulting in no significant difference between the experimental and control groups at the final rating.

This instructor was the only one for which patterns C and D were obtained. Pattern C was obtained for the item Class Discussion and Questions. This pattern resulted from a significant negative difference between the midterm and final rating of the experimental group while the control group remained essentially the same. Pattern D was obtained for the items Poise and Self-Confidence, and Ability to Create Student Interest. This pattern resulted from a positive difference for the control group between the midterm and final ratings while the experimental group remained constant. This final negative significant difference resulted from the experimental group not sharing in the positive increase in ratings exhibited by the control group.

The item Scholarship showed a significant negative difference at the midterm rating and maintained it at the final rating. The item Sense of Humor showed a significant negative difference at the final rating but this was due to a change in the spread of the scores, since a difference of the same magnitude at the midterm ratings does not show significance.

Student Achievement

The results of the comparison of student achievement scores for the physical science instructor are summarized in Table 9. The null hypothesis

cannot be rejected. For this instructor the use of the student response system during the last five weeks of the course produced no significant difference in the scores of the students on the instructor's tests even when adjusted for any possible difference during the first five weeks of the course.

TABLE 9
COMPARISON OF STUDENT ACHIEVEMENT SCORES
FOR PHYSICAL SCIENCE INSTRUCTOR

	First Five-Week Period			Second Five-Week Period		
Item	N	M	SD	N	M	SD
Experimental	66	80.5	14.4	66	91.1	7.50
Control	70	80.7	15.6	70	90.6	8.93
Difference	- 0.2			0.5		
F ratio ^a	0.27					

^aDetermined from an analysis of covariance with the first five-week scores as the covariant. The critical F ratio is 3.92 for the 0.05 level of significance.

Anthropology Instructor

Student Ratings

The results of the anthropology instructor are summarized in Table 10. Pattern A, supportive of the first hypothesis, was obtained for three of the seventeen questionnaire items. The other items were Judgment of

TABLE 10

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL ^a				DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL ^b			
	FOR CONTROL		FOR EXPERIMENTAL		AT MIDTERM		AT FINAL	
	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO	DIFF	F-RATIO
1. Organization of Course ^d	.69	3.85	.64	3.68	.01	.00	-.04	.01
2. Preparation for Each Class ^d	.35	1.28	.28	.92	.13	.20	.06	.05
3. Teaching Skill ^d	.42	.86	.63	3.04	.46	1.02	.67	3.12
4. Enthusiasm and Interest in Course ^d	.47	.76	.43	1.88	.67	1.65	.62	2.74
5. Assignments	-.58	.97	.09	.07	.33	.53	.71	2.01
6. Judgment of Values	.38	1.42	.60	4.10 ^c	-.02	.00	.16	.49
7. Class Discussion and Questions ^d	.58	1.11	.38	.69	.45	.75	.28	.29
8. Poise and Self Confidence ^d	-.10	.03	.61	2.42	.54	1.02	1.31	7.63 ^c
9. Examinations	-.11	.04	.55	1.94	-.59	1.39	.07	.02
10. Scholarship	.04	.02	.00	.00	.04	.01	.10	.12
11. Ability to Create Student Interest ^d	.34	.45	.47	.94	.46	.73	.85	3.85
12. Classroom Management and Discipline ^d	-.02	.00	.23	.53	-.39	.99	.12	.15

TABLE 10--Continued

ITEM	DIFFERENCE IN RATING FROM MIDTERM TO FINAL		DIFFERENCE IN RATING BETWEEN CONTROL AND EXPERIMENTAL	
	FOR CONTROL		AT MIDTERM	
	DIFF	F-RATIO	DIFF	F-RATIO
13. Speech	.50	2.09	.36	1.28
14. Tolerance	-.04	.01	.98	3.59
15. Sense of Humor	.04	.01	.56	1.46
16. Personal Appearance	.00	.00	.17	.19
17. Relationship Between Students and Instructor ^d	.11	.06	.57	3.67
			.19	.28
			-.13	.05
			.42	.49
			.03	.00
			.07	.02
			.09	.08
			.84	3.47
			.96	5.30 ^c
			.33	.91
			.51	2.17

^aDifference was obtained by subtracting the mean rating at final from the mean rating at midterm. A positive difference indicates a change to a more favorable rating at the final rating.

^bDifference was obtained by subtracting the mean rating of the experimental group from the mean rating of the control group. A positive difference indicated a more favorable rating by the experimental group.

^cThe critical ratio is 4.05 for the 0.05 level of significance.

^dQualities listed in first research hypothesis.

Values and Sense of Humor. In all three of these items the pattern indicates that the experimental group underwent a positive difference between midterm and final ratings while the control group stayed essentially the same.

Student Achievement

The results of the comparison of student achievement scores for the anthropology instructor are summarized in Table 11. The null hypothesis cannot be rejected. For this instructor, the use of the student response system during the last five weeks of the course produced no significant difference in the scores of the students on the instructor's tests even when adjusted for any possible difference during the first five weeks of the course.

TABLE 11
COMPARISON OF STUDENT ACHIEVEMENT SCORES
FOR ANTHROPOLOGY INSTRUCTOR

Item	First Five-Week Period			Second Five-Week Period		
	N	M	SD	N	M	SD
Experimental	31	20.6	4.10	31	17.4	6.02
Control	32	20.6	4.36	32	19.0	4.15
Difference	0.0			- 1.6		
F ratio ^a				1.8		

^aDetermined from an analysis of covariance with the first five-week scores as the covariant. The critical F ratio is 5.98 for the 0.05 level of significance.

Summary of Results

Table 12 summarizes the results of the various significant differences in the scores obtained on A Student's Rating of an Instructor for each instructor. The meaning of each pattern of significant differences noted by the letters A, B, C, and D in the table is discussed in the introduction to this chapter.

For the qualities specifically listed in the first research hypothesis (that students would rate an instructor more favorably on qualities related to his classroom teaching behavior when he received in-class feedback through a student response system), pattern A shows support for ten of the sixty-eight combinations of instructor and questionnaire items. For the other items on the questionnaire, pattern A shows support for eleven of the sixty-eight combinations.

The second research hypothesis (that the achievement of students on examinations of the subject matter of the course would be higher for the class in which the instructor received in-class feedback through the student response system) was not supported for any of the instructors.

TABLE 12

SUMMARY OF THE PATTERNS OF SIGNIFICANT DIFFERENCES
OBTAINED BY EACH INSTRUCTOR FOR EACH ITEM ON
A STUDENT'S RATING OF AN INSTRUCTOR

Item	Interaction Significant?	Pattern ^b			
		Econ	Chem	Phy Sci	Anthro
1. Organization of Course ^a	No	A	B	A	
2. Preparation for Each Class ^a	No	A			
3. Teaching Skill ^a					
4. Enthusiasm and Interest in Course ^a	No	A			
5. Assignments	Yes	A			
6. Judgment of Values	No	A			A
7. Class Discussion and Questions ^a	No			C	
8. Poise and Self-Confidence ^a	Yes		A	D	A
9. Examinations	No	A			
10. Scholarship	Yes	A	B		
11. Ability to Create Student Interest ^a	No			D	
12. Classroom Management and Discipline ^a	No	A			
13. Speech	Yes	A	A		
14. Tolerance	Yes		A	D	
15. Sense of Humor	Yes	A			A
16. Personal Appearance	Yes		A		
17. Relationship between Students and Instructor ^a	Yes		A		

^aQualities listed in first research hypothesis.

^bSee the introduction to this chapter and Figure 2 for an explanation of these patterns.

CHAPTER IV

CONCLUSIONS AND SUMMARY

Changes in Student Ratings of Instructors

This investigation produced evidence that for three of the four replications of the experiment the instructors involved improved the quality of their classroom teaching behavior as perceived by the students in the classes in which the instructor received in-class feedback through the student response system. At the 0.05 level of significance, one item of a seventeen-item questionnaire might be expected to show a significant difference due to random errors. The least number for any instructor in this investigation was three significant differences. Of the fifty-one combinations of instructor and questionnaire item for these three instructors, three might be expected to show a significant difference at the .05 level of significance due to random errors. Twenty combinations showed significant differences which indicated improvement in teaching behavior as perceived by the students.

This improvement was not limited to the qualities listed in the first research hypothesis. Moreover, no one quality listed on the questionnaire showed improvement for all three instructors and only one item, Class Discussions and Questions, failed to show improvement for at least one of these three instructors. These results probably indicate that the selection at face validity of qualities expected to change as a result of the influence of in-class feedback through the student response system was not accurate. Rather, the results indicate that for these three

instructors a general improvement in classroom behavior was perceived by the students in those classes in which the instructor was receiving feedback through the student response system. All of the items on the questionnaire were probably measuring the same student perception of improvement in classroom teaching behavior.

The significant changes in the ratings were uniformly positive for three of the four instructors. For the fourth instructor (physical science), the changes were negative for the experimental group on those items which exhibited a change except for the one item, Organization of Course.

In this particular case, there is evidence to indicate that the instructor was a highly-rated instructor and the student response system actually got in the way of the relationship that had been built up between the instructor and the students. Of all the ratings given at any time for this instructor, no rating was less than 2.67. The mean ratings given at midterm were between 1.11 and 2.47. With a value of 1.00 being the highest rating that could be given, it would be difficult for any instructor to show improvement from mean ratings between 1.11 and 2.47.

In addition, the items Poise and Self Confidence, and Sense of Humor, showed a final negative significant difference between control and experimental groups at the final ratings. These items might be expected to change unfavorably in a frustrating situation.

The conclusions above were also supported by remarks made by the instructors themselves when interviewed by the investigator during the week following the end of the quarter. This was an informal interview which simply solicited the remarks of the instructors about their

experiences with the student response system. They all agreed that they missed the feedback which was not presented in the control group. The economics instructor observed that he felt that he covered less material in the experimental group and had been teaching toward the lower half of the class. Most significantly, they all agreed that they wanted to continue using the student response system, although they were of the opinion that it would be more effective in a larger classroom with larger numbers of students.

The interview with the physical science instructor indicated that his traditional method of teaching included a great deal of verbal feedback from at least a few of the students, even in large classes. When he moved into the experimental situation he discontinued this practice. Evidently, this instructor had developed a method of receiving the necessary feedback to adapt his presentation to the students and the student response system actually was a hindrance. His teaching method was somewhat like that of a television instructor with a small studio class. An adequate verbal interaction was maintained between the instructor and a small number of students while the rest vicariously participated in the interaction.

The observations of the physical science instructor along with the statistical analysis of the interaction between instructor and student response system seemed to indicate an interplay between the style of teaching and the usefulness of the feedback obtained through the student response system. For instructors whose primary style is lecturing, the student response system feedback is potentially useful, since other types of verbal feedback are not available. If verbal feedback is available or

sought, then the feedback from the student response system is less useful. This would definitely indicate its potential usefulness in large classes where verbal feedback is not possible.

This conclusion is further supported by the observation that, for the three instructors who showed improvement in student ratings, the instructor with the largest class (economics) had the largest number of positive differences, while the instructor with the smallest class (anthropology) had the smallest number of positive differences in favor of the experimental group.

Student Achievement

This investigation produced no evidence that student achievement was affected by the instructor receiving feedback through the student response system. No significant differences were found in the achievement of the classes as measured by the teacher-made tests.

Suggestions for Further Research

The duration of this investigation may not have been long enough to indicate differences in student achievement that could be attributed to the in-class feedback received by the instructor. Further investigation might utilize the same experimental format for longer periods, such as a full quarter or a year in a course.

A modification of the student response system can enable automatic printout of student responses during a class presentation. Thus, as the students indicate by responses A or B whether or not they feel they are understanding the presentation, these scores could be periodically

recorded. Differences might be found in the on-going level of understanding as measured by the percentages of responses indicating that the students feel they are understanding the material being presented. An investigation of this sort would give more definite support to the hypothesis that the instructor is actively responding in class to the feedback he is receiving.

Since for these four instructors differences were found on only some of the items in the questionnaire used, the development of a longer rating instrument based on these items (and refinements of them) might be used to determine in what areas the student response system's feedback is particularly useful.

In addition, since there was some indication that all of the items on the questionnaire were measuring the same thing, a longer questionnaire might be analyzed factorially to determine groupings of items which would indicate significantly different qualities which could be separated by the students in their perceptions of instructor classroom teaching behavior. Such groupings of items might also provide a more reliable questionnaire.

In this investigation, two types of feedback were used: feedback obtained from students to multiple-choice questions and feedback obtained from continual monitoring by the students of whether they felt they were understanding the material being presented. Further investigations might separate these two types of feedback. Does the instructor use the feedback obtained from multiple-choice questions to review material not being understood by a significant portion of the class? Does the instructor adapt the level of understanding as indicated by whether the students feel they are comprehending the material?

There was some indication in the remarks of the instructors during the interviews that they perceived themselves as teaching to the needs of the slower or less intelligent members of the class. The significant differences may have been due to a change only in this lower portion of each class. A further investigation might determine if the student ratings of the instructor changed more for the less able students.

Summary

The results of this investigation indicated that the effect of the systematic student response varied significantly for the different instructors and therefore should be generalized to other instructors only with appropriate caution. Within this limitation the results supported the hypothesis that certain instructors improved their classroom teaching behavior as perceived by their students when these instructors received in-class feedback through a student response system. There were indications that this improvement in student rating was greater for those instructors whose teaching style or size of class did not permit significant verbal in-class feedback from the students.

The results of this investigation did not support the hypothesis that the achievement of students on examinations of the subject matter of the course would be higher for the class in which the instructor received in-class feedback through the student response system.

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APPENDIX A

Appendix A

RESPONSE SYSTEMS CORPORATION'S STUDENT RESPONSE SYSTEM

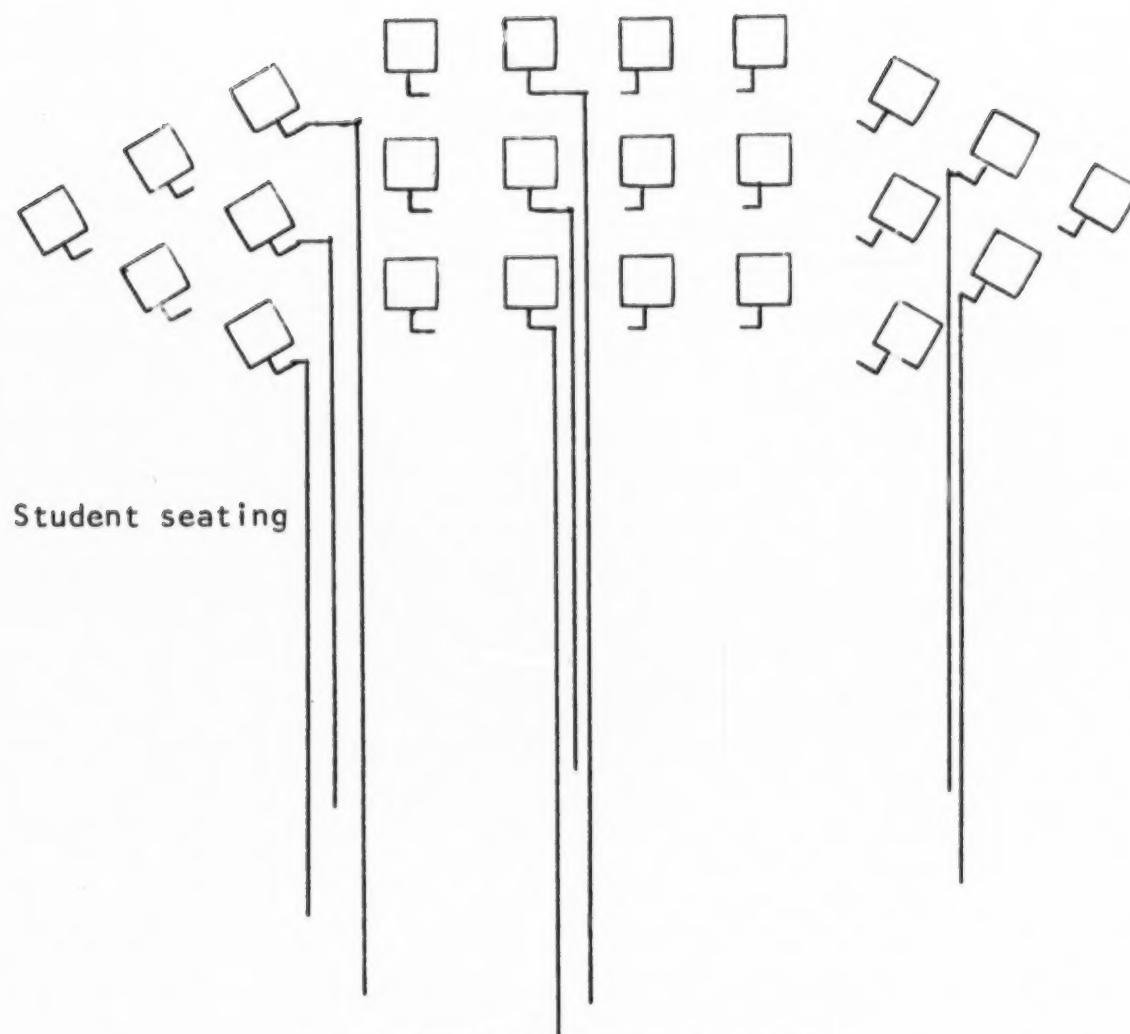
Complete System

For the instructor, the complete system is illustrated in Figure 1. The system consists of four portions. These are the instructor's console, the student units, the central electronics unit, and the printer.

It is desirable to assign a number to each seat location. The wiring has been designed around groups of not more than ten seats; and these seats should be close to each other in order. The ten seats need not necessarily be in one row. For example, they may be in one of the small groups of seats shown in Figure 1. For the instructor, the seat identification is directly correlated to both his console display, and his typewriter record of the students' names. He can direct any of his discussions directly to a particular student by name. The seat number is of little value to the lecturer. At each of these locations, there is a STUDENT UNIT (Figure 3). Through these student units, the students transmit their names, and answer to questions. The student units may be either permanently fixed to the desk, or a plug-in module.

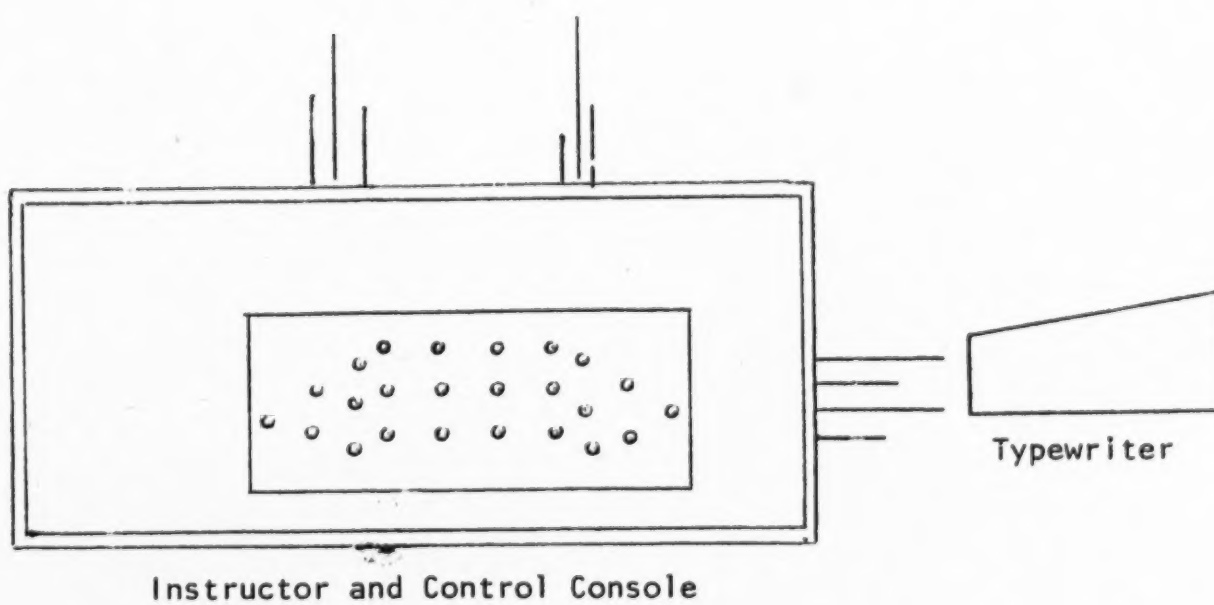
Instructor's Console (CP)

The INSTRUCTOR'S CONSOLE, Figure 2, is placed so that is convenient for the instructor. It is through this unit, the control center of the entire system, that the lecturer controls the student response system and



Student seating

Student UNIQUE lines to console



Instructor and Control Console

Typewriter

Figure 1.--Student Response System

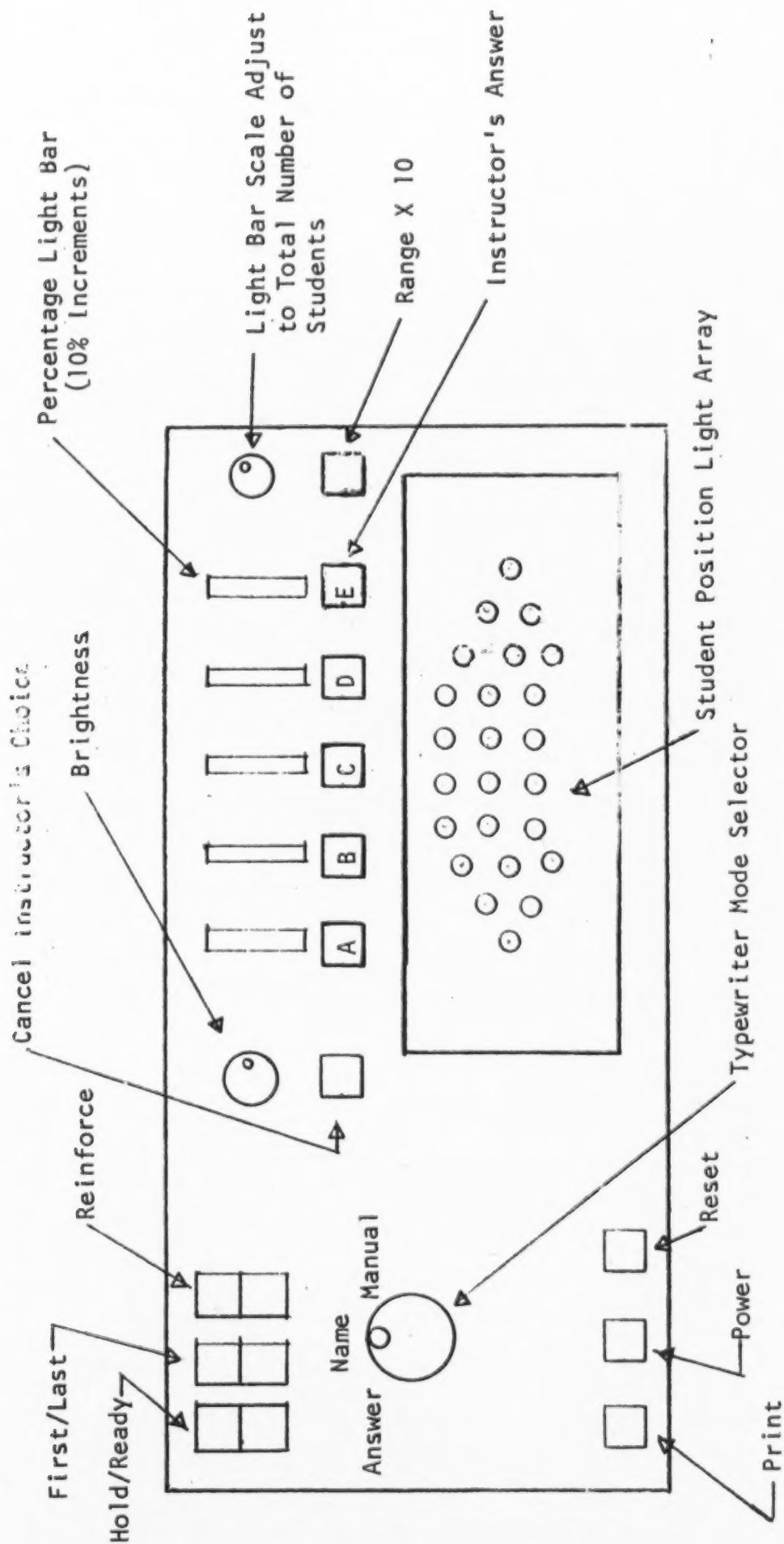


Figure 2.--Instructor's Console Display

determines the level of understanding of his class. The major portion of the display panel is an array of small lights having the same configuration as the students' seating positions. This light pattern indicates whether or not his answer is correct. The miniature light bulbs used in this panel are similar to those used in the Student Units. The bulbs are operated at a voltage level that assures very long life expectancy. Each of these light bulbs is connected directly to the output of the information line from its corresponding seat position. The main power is controlled by a switch and a dimmer control is provided to adjust the illumination of the light bulbs to the classroom's background lighting.

Also, on the left-hand side of the control console is a three-position selector switch. These positions are designated as MANUAL, NAME, and ANSWER. Two of these positions are used in conjunction with an electric typewriter for recording of either the students' names, or their answers. When the switch is in the manual position, the instructor is still able to tell the answers as given by the student, by the characteristics of the illuminations of the bulbs on the instructor's console. In addition, the instructor has complete access to use the typewriter for inserting additional information such as the course name, date, etc. When the switch is placed in the NAME mode, the student response system can record the names of all the students. After switching to name mode, the instructor usually asks the class to turn the alphabet wheel to the first initial of their given names. The students are asked to depress the upper right hand activate letter button of their student wheel after the wheel is on the correct letter. The corresponding indicator lights on the instructor's console will light when the activate letter button has been pushed indicating which students have set their units to transmit the

proper letter. The instructor may then press the PRINT switch. The typewriter will then sequentially print all the letters, and will automatically stop after the last seat. In the event that there are seat vacancies or that the student does not depress the activate letter button, a vacant space will appear on the typewriter sheet. After this printing operation, the controls reset the entire system back at its setting prior to the recording operation. The entire procedure is repeated for each series of letters to be recorded. When a student has recorded all the letters of his name, he no longer presses the space letter button even though other members of the class with longer names continue to record letters. When the controls are in the print mode, all other operations as indicated on the control panel are inoperative. In the NAME mode, the initial received from the first seat position is recorded in either the second or third position of the carriage return. This positioning is done in order to provide a space so that when the print cycle is in the ANSWER mode that the first column will indicate the instructor's correct answer choice (A, B, C, D, or E), the second column may contain a blank space, and the third column will be the student's answer choices positioned directly under his name. In the ANSWER mode, one of six letters can be printed. Should the student select the correct answer, the instructor's input of this is described later and a letter "I" will be recorded under the student's name. For an incorrect answer, one of the five letters, A, B, C, D, or E, that the student chooses will be indicated. The recording rates of the typewriters are ten or more characters per second. For seventy-two students, the recording time for one set of complete answers or set of student name letters may be less than ten (10) seconds.

Immediately above the student position light array on the console are located five vertical columns. There is one column for each of the answers, A, B, C, D, or E. Each light bar has ten miniature light bulbs. In operation, these bulbs will show the percentage of the total number of students who have selected the answer indicated. For ten per cent of the students responding to one answer, the first light bulb on the bottom of the scale will light; for twenty per cent, the first and second bulbs will be on. For each additional ten per cent, an additional light bulb will illuminate. If the student percentage response is less than ten per cent for any of the answer selections, and should the instructor desire to know the amount, there is available a selection procedure to alter the full range of the LIGHT BAR to ten per cent of the total number of students. Pressing the RANGE X10 switch changes the corresponding column to a full scale for ten per cent of the students selecting that choice. The PERCENTAGE LIGHT BAR system is initially set for the total number of student positions. But, if there is not full occupancy, then it is necessary that the system be adjusted to the total number of participants. This adjustment is available in the control positioned in the upper right hand corner of the instructor's console; LIGHT BAR SCALE ADJUST or RANGE. The instructor can make this adjustment by first placing the console's selector mode in the ANSWER position and asking all of the students present to press a single answer switch. The instructor can then rotate the LIGHT BAR SCALE ADJUST until the full scale, i.e., all ten indicating lights, are on. This setting remains for the particular class period, and requires readjustment at the beginning of another class section if a different number of students is present.

The instructor's choice is inserted by pressing one of the five buttons marked A, B, C, D, or E, below the answer distribution lights. The choice can be changed at will by the instructor making a new choice, which will cancel out the old. The instructor's choice is used in the printout and the lights on the control console of students who have selected the same answer as the instructor are bright; other student positions are indicated by dim lights. The instructor's choice also determines which answers are to be reinforced -- to be described later on.

The instructor may make his choice at any time, including before any student answers.

The Instructor's choice is automatically cleared by reset, pressing the CANCEL CHOICE button, or at the end of print cycle.

Located at the upper left hand corner of the console are three switches. They are FIRST/LAST (F/L), REINFORCE, and HOLD/READY (H/R). These functions are utilized in both the MANUAL and non-recording ANSWER modes. The F/L selector switch represents two different selection choices of the students' answers that the instructor may select. The LAST, or L, selection permits the students to select and to change answers at will. However, when the print procedure is initiated, the system is frozen. For the FIRST, or F, position, the student can make but one answer selection choice. Once he has made a choice, further pressing of buttons on the student unit has no effect. The instructor should normally RESET, to remove the answers from all student units prior to setting the F position. The LIGHT BARS and the panel lighting array provide the instructor with a readily available method of analysis of the answers given. Based on this information, the instructor may alter his presentation to improve

the learning. The READY selection of the H/R switch puts the entire system in an operable condition; whereas the HOLD selection locks the entire system and prevents the students from making any changes or additions. When the system is returned to READY from HOLD, it is as though no HOLD had occurred. When the PRINT action is initiated, the entire system, irrespective of any settings, is placed in the HOLD position. The system is automatically reset after each print operation.

The RESYC system permits the instructor to provide a psychological reward, given to the student upon the selection of the correct answer. The effect of reinforcement on the student unit is described later. As soon as the student selects any answer, his lamp on the instructor's display glows at half power. When the instructor presses the correct answer selection button, all correct answer lamps in his display are brightened to full power. When the students are being reinforced (REINFORCE ON), the correct answer choice on the console is modulated on and off at a rate of five to six times per second.

Student Unit (Figure 3, Half Size)

At each student position, there is located a Student Unit. On the right of the unit is a twenty-six position rotary wheel. Each of the positions correspond to a given letter of the alphabet. At the center of the visible portion of the wheel is an engraved arrow which is to indicate the letter chosen by the student for transmission to the typewriter. During the NAME modes of operation, the selected letter is illuminated. However, to activate transmission of the letter, the student must depress the activate letter button in the upper right hand corner of his unit.

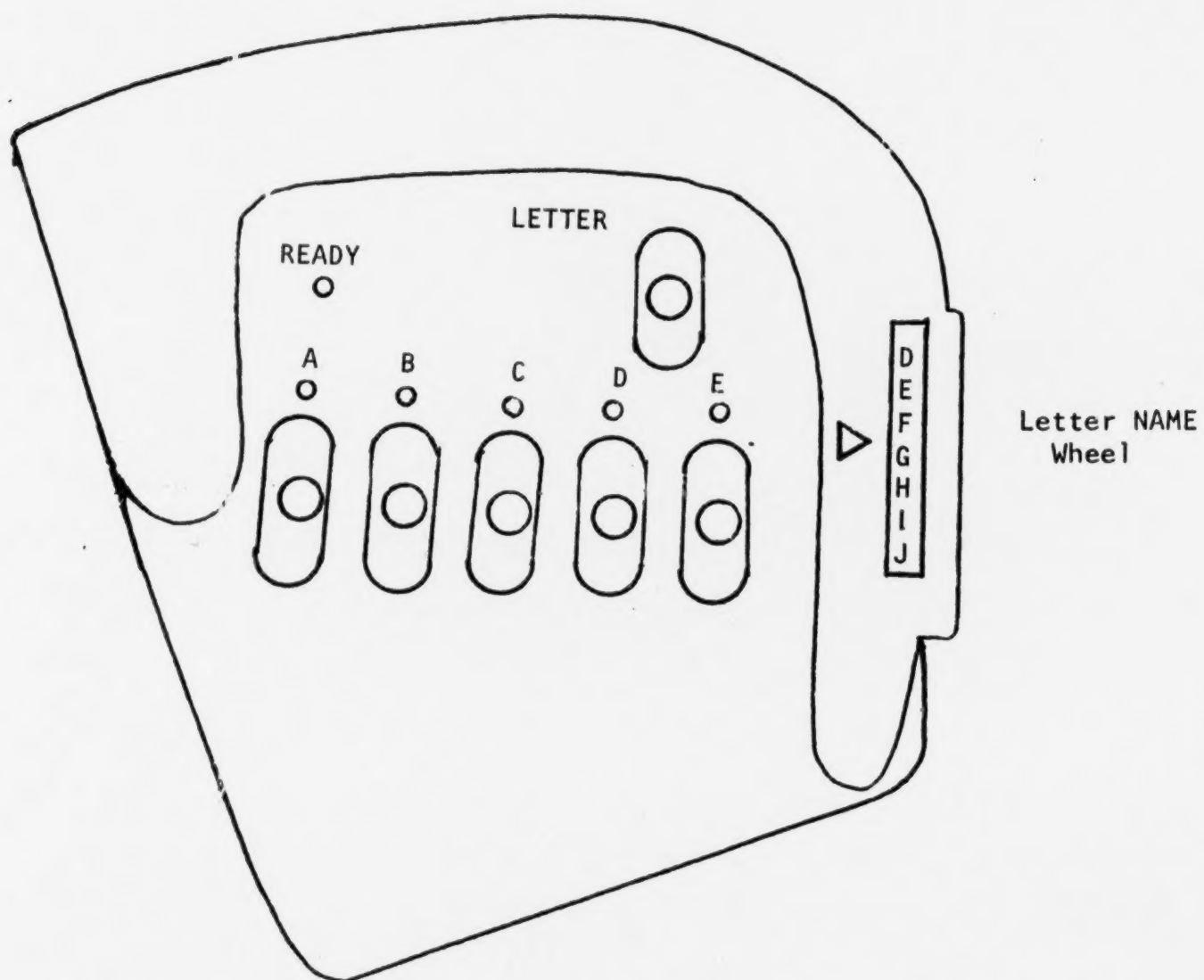


Figure 3.--Student Unit

If this latter action is not carried out, a blank space will be indicated on the typewriter record.

At the beginning of each class section, the students in cooperation with their instructor may be requested to use the student unit to transmit their name for the typewriter record. This is particularly valuable if permanent seats are not assigned. The instructor requests the student to position the lettered wheel to the first initial of his chosen name. After completing the initial setting, the activate letter button is pressed down by the student. The instructor thereupon will direct the typewriter, by pressing the PRINT button of the console, to record all the first initials of the students. The system resets at the end of the printout, and the same procedure is then followed for subsequent letters.

The second mode of operation for the student unit is response to the instructor's questions. After setting the manual rotary switch to the ANSWER mode, the instructor will then set the F/L switch to the desired setting. In either position, the READY light (upper left) at the student units will be turned on. When in the first (F) position, the READY light will remain on until the student depresses any one of the five answer buttons. This will then turn off the READY light and simultaneously turn on the light above the selected answer switch. This light, normally visible only to that student, reminds him of the answer he has selected and assures him that his selection has been entered into the system. Subsequent activating of any other answer buttons will not alter the previous selection. In the LAST position, the READY light remains always on; and the student, at will, can make changes in the

answer choice. When printing is initiated, the last selected answer is permanently set. At the end of the print cycle only the READY light remains on.

When the HOLD button is on, the READY light goes out, and no new answer may be entered nor can the student who has made no choice do so. A student who tries to defeat the system by holding down several buttons simultaneously will be recorded as having given no answer. The instructor's display, however, will show that an answer has been selected. Regardless of the instructor's choice, all answer lights show the same brightness. The student cannot "shop" for the right answer with success. When REINFORCE is on, however, the "correct" answer light, if on, will pulsate, telling the student that he has made the best choice. This is true whether in FIRST or LAST answer mode.

The material in this appendix was adapted from the preliminary edition of the Operator's and Technical Manual prepared by Response Systems Corporation and used with their permission.

APPENDIX B

Appendix B

A STUDENT'S RATING SCALE OF AN INSTRUCTOR

Instructor's name (Please print) _____ Course _____ Date _____

Each of the qualities listed below is divided into three sections. Each section is divided into three degrees and numbered accordingly from 1 to 9, 1 being the highest degree and 9 the lowest. In rating, draw a circle around the number which best describes your instructor.

Your fair and honest opinion is what really counts. Your instructor desires this rating for his own self-improvement.

ORGANIZATION OF COURSE	1 Well organized; shows thoughtful planning.	2 Shows definite evidence of careful preparation.	3 Shows some preparation; average knowledge of course.	4 Some organization but not always clear.	5 Teaching procedure seldom changes; student interest moderate.	6 Lacks organization; planning seems vague.	7 Not well prepared; knowledge inaccurate at times.	8 Classes tend to be dry and uninteresting; class period drags.	9
PREPARATION FOR EACH CLASS	1 Shows definite evidence of careful preparation.	2 Shows some preparation; average knowledge of course.	3 Not well prepared; knowledge inaccurate at times.	4 Shows definite evidence of careful preparation.	5 Shows some preparation; average knowledge of course.	6 Not well prepared; knowledge inaccurate at times.	7 Shows definite evidence of careful preparation.	8 Shows some preparation; average knowledge of course.	9 Not well prepared; knowledge inaccurate at times.
TEACHING SKILL	1 Produces steady interest in subject; creates real desire; keeps things moving.	2 Teaching procedure seldom changes; student interest moderate.	3 Classes tend to be dry and uninteresting; class period drags.	4 Produces steady interest in subject; creates real desire; keeps things moving.	5 Teaching procedure seldom changes; student interest moderate.	6 Classes tend to be dry and uninteresting; class period drags.	7 Produces steady interest in subject; creates real desire; keeps things moving.	8 Teaching procedure seldom changes; student interest moderate.	9 Classes tend to be dry and uninteresting; class period drags.
ENTHUSIASM AND INTEREST IN COURSE	1 Keeps up steady interest and enthusiasm. Inspires interest in subject.	2 Appears to be reasonably interested.	3 Seems to teach course without enthusiasm.	4 Keeps up steady interest and enthusiasm. Inspires interest in subject.	5 Appears to be reasonably interested.	6 Seems to teach course without enthusiasm.	7 Keeps up steady interest and enthusiasm. Inspires interest in subject.	8 Appears to be reasonably interested.	9 Seems to teach course without enthusiasm.
ASSIGNMENTS	1 Students understand the tasks of each new assignment. Students know what is desired.	2 Sometimes rather indefinite; without clear planning.	3 Usually hurriedly given; rather vague; sometimes very unreasonable.	4 Students understand the tasks of each new assignment. Students know what is desired.	5 Sometimes rather indefinite; without clear planning.	6 Usually hurriedly given; rather vague; sometimes very unreasonable.	7 Students understand the tasks of each new assignment. Students know what is desired.	8 Sometimes rather indefinite; without clear planning.	9 Usually hurriedly given; rather vague; sometimes very unreasonable.
JUDGMENT OF VALUES	1 Usually selects important ideals; broadens student view points.	2 Sometimes overlooks important points, spending time on insignificant details.	3 Frequently misses important ideas; overemphasizes trivial details.	4 Usually selects important ideals; broadens student view points.	5 Sometimes overlooks important points, spending time on insignificant details.	6 Frequently misses important ideas; overemphasizes trivial details.	7 Usually selects important ideals; broadens student view points.	8 Sometimes overlooks important points, spending time on insignificant details.	9 Frequently misses important ideas; overemphasizes trivial details.
CLASS DISCUSSION AND QUESTIONS	1 Questions challenging; demand sound thinking; discussions interesting and stimulating.	2 Questions rather easy and simple; memorized facts emphasized.	3 Discussion sometimes without purpose; discussions frequently ramble.	4 Questions challenging; demand sound thinking; discussions interesting and stimulating.	5 Questions rather easy and simple; memorized facts emphasized.	6 Discussion sometimes without purpose; discussions frequently ramble.	7 Questions challenging; demand sound thinking; discussions interesting and stimulating.	8 Questions rather easy and simple; memorized facts emphasized.	9 Discussion sometimes without purpose; discussions frequently ramble.
POISE AND SELF-CONFIDENCE	1 Well poised; sure of himself; not easily upset.	2 Seems embarrassed at times; fairly self-confident.	3 Easily upset; uncertain as to procedure; lacks confidence.	4 Well poised; sure of himself; not easily upset.	5 Seems embarrassed at times; fairly self-confident.	6 Easily upset; uncertain as to procedure; lacks confidence.	7 Well poised; sure of himself; not easily upset.	8 Seems embarrassed at times; fairly self-confident.	9 Easily upset; uncertain as to procedure; lacks confidence.
EXAMINATIONS	1 Questions thought-provoking; carefully selected; clear.	2 Questions usually factual; require little thinking.	3 Examinations poorly planned and managed.	4 Questions thought-provoking; carefully selected; clear.	5 Questions usually factual; require little thinking.	6 Examinations poorly planned and managed.	7 Questions thought-provoking; carefully selected; clear.	8 Questions usually factual; require little thinking.	9 Examinations poorly planned and managed.
SCHOLARSHIP	1 Excellent mastery of subject; has broad interests.	2 Knowledge fair but without depth.	3 Knowledge frequently inadequate. Instructor seems vague.	4 Excellent mastery of subject; has broad interests.	5 Knowledge fair but without depth.	6 Knowledge frequently inadequate. Instructor seems vague.	7 Excellent mastery of subject; has broad interests.	8 Knowledge fair but without depth.	9 Knowledge frequently inadequate. Instructor seems vague.
ABILITY TO CREATE STUDENT INTEREST	1 Usually keeps steady interest in subject; stimulates thinking.	2 Students have average amount of interest.	3 Classes drag and students are indifferent.	4 Usually keeps steady interest in subject; stimulates thinking.	5 Students have average amount of interest.	6 Classes drag and students are indifferent.	7 Usually keeps steady interest in subject; stimulates thinking.	8 Students have average amount of interest.	9 Classes drag and students are indifferent.
CLASSROOM MANAGEMENT AND DISCIPLINE	1 Efficient management; students orderly and attentive.	2 Satisfactory organization; few disciplinary problems.	3 Poor organization; many disciplinary problems.	4 Efficient management; students orderly and attentive.	5 Satisfactory organization; few disciplinary problems.	6 Poor organization; many disciplinary problems.	7 Efficient management; students orderly and attentive.	8 Satisfactory organization; few disciplinary problems.	9 Poor organization; many disciplinary problems.
SPEECH	1 Voice pleasant; speaks distinctly, fluently.	2 Speaks reasonably well.	3 Enunciation poor; makes frequent errors in speech.	4 Voice pleasant; speaks distinctly, fluently.	5 Speaks reasonably well.	6 Enunciation poor; makes frequent errors in speech.	7 Voice pleasant; speaks distinctly, fluently.	8 Speaks reasonably well.	9 Enunciation poor; makes frequent errors in speech.
TOLERANCE	1 Encourages students to express opinions even though they differ with the instructor's ideas.	2 At times appears to be disturbed and impatient when students oppose instructor's views.	3 Resents opposition; intolerant.	4 Encourages students to express opinions even though they differ with the instructor's ideas.	5 At times appears to be disturbed and impatient when students oppose instructor's views.	6 Resents opposition; intolerant.	7 Encourages students to express opinions even though they differ with the instructor's ideas.	8 At times appears to be disturbed and impatient when students oppose instructor's views.	9 Resents opposition; intolerant.
SENSE OF HUMOR	1 Possesses keen sense of humor.	2 Moderately humorous at times.	3 Shows little or no sense of humor; quite sober and serious.	4 Possesses keen sense of humor.	5 Moderately humorous at times.	6 Shows little or no sense of humor; quite sober and serious.	7 Possesses keen sense of humor.	8 Moderately humorous at times.	9 Shows little or no sense of humor; quite sober and serious.
PERSONAL APPEARANCE	1 Neatly and appropriately dressed; well groomed.	2 Appearance fair; makes average impression.	3 Careless in dress; untidy.	4 Neatly and appropriately dressed; well groomed.	5 Appearance fair; makes average impression.	6 Careless in dress; untidy.	7 Neatly and appropriately dressed; well groomed.	8 Appearance fair; makes average impression.	9 Careless in dress; untidy.
RELATIONSHIP BETWEEN STUDENTS AND INSTRUCTOR	1 Attitude of friendliness; feeling of mutual interest; easily approached.	2 Neither ill-will nor friendliness prevails; attitude somewhat indifferent.	3 Considerable spirit of antagonism between students and instructor.	4 Attitude of friendliness; feeling of mutual interest; easily approached.	5 Neither ill-will nor friendliness prevails; attitude somewhat indifferent.	6 Considerable spirit of antagonism between students and instructor.	7 Attitude of friendliness; feeling of mutual interest; easily approached.	8 Neither ill-will nor friendliness prevails; attitude somewhat indifferent.	9 Considerable spirit of antagonism between students and instructor.

PRINT your criticisms of the course. These will be very helpful for your instructor's self-improvement. Do not sign your name. On the back of this form PRINT any annoying mannerisms your instructor has developed which should be corrected.

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APPENDIX C

TABLE 1

RELIABILITY OF A STUDENT'S RATING SCALE OF AN INSTRUCTOR

Item	Midterm			Final			Difference ^a	F Ratio	Coeff. of Corr.
	N	M	SD	N	M	SD			
1. Organization of Course ^b	38	3.03	1.48	38	2.89	1.54	.14	0	.66
2. Preparation for Each Class ^b	38	2.79	1.34	38	2.79	1.30	0	0	.79
3. Teaching Skill ^b	38	3.55	1.48	38	3.47	1.52	.08	0	.73
4. Enthusiasm and Interest in Course ^b	38	3.21	1.47	38	3.11	1.59	.10	0	.58
5. Assignments	38	2.16	1.61	38	2.45	1.45	-.29	.82	.30
6. Judgment of Values	38	2.82	1.67	38	3.00	1.38	-.18	0	.49
7. Class Discussion and Questions ^b	38	3.37	1.49	38	3.26	1.62	.11	0	.67
8. Poise and Self-Confidence ^b	38	2.76	1.49	38	2.79	1.70	-.03	0	.55
9. Examinations	38	2.53	1.21	38	2.79	1.38	-.26	.57	.41
10. Scholarship	38	2.76	1.24	38	2.84	1.61	-.08	0	.38
11. Ability to Create Student Interest ^b	38	3.86	1.49	38	3.66	2.02	.02	0	.64
12. Classroom Management and Discipline ^b	38	2.21	1.32	38	2.37	1.55	-.16	.47	.30

Table 1 -- Continued

Item	Midterm			Final			Difference ^a Mid-Final	F Ratio	Coeff. of Corr.
	N	M	SD	N	M	SD			
13. Speech	38	3.47	2.10	38	3.66	1.77	-.19	.26	.60
14. Tolerance	38	2.21	1.34	38	2.53	1.35	-.32	1.06	.30
15. Sense of Humor	38	3.05	1.64	38	3.00	1.86	.05	0	.30
16. Personal Appearance	38	1.58	1.18	38	1.45	1.35	.13	0	.08
17. Relationship between Students & Instructor ^b	38	2.18	1.47	38	1.92	1.48	.26	.89	.39

^aDifference was obtained by subtracting the final mean rating from the midterm mean rating.
A positive difference indicates a more favorable rating.

^bQualities listed in first research hypothesis.

TABLE 2

COMPARISONS OF STUDENT RATINGS OF ECONOMICS INSTRUCTOR FOR A TRADITIONAL CLASS

Item	Midterm			Final			Difference ^a	F-Ratio
	N	M	SD	N	M	SD		
1. Organization of Course ^c	49	3.22	1.21	44	3.36	1.54	-.14	0.24
2. Preparation for Each Class ^c	48	2.85	1.62	43	3.07	1.50	-.22	0.43
3. Teaching Skill ^c	49	3.63	1.86	43	4.56	2.03	-.93	5.22 ^b
4. Enthusiasm and Interest in Course ^c	48	3.38	1.57	44	3.77	1.54	-.39	1.51
5. Assignments	47	3.02	1.75	43	3.86	1.41	-.84	6.21 ^b
6. Judgment of Values	47	2.79	1.44	44	3.14	1.27	-.35	1.49
7. Class Discussion and Questions ^c	48	3.40	2.19	43	3.37	1.88	.03	0.00
8. Poise and Self Confidence ^c	48	1.75	1.64	44	2.04	0.99	-.29	1.07
9. Examinations	48	2.88	1.76	44	3.02	1.92	-.14	0.15
10. Scholarship	47	2.55	1.23	44	2.89	1.40	-.34	1.46
11. Ability to Create Student Interest ^c	49	3.94	2.19	44	4.84	2.20	-.90	3.91
12. Classroom Management and Discipline ^c	47	2.23	1.32	44	2.52	1.09	-.29	1.28

Table 2 -- Continued

Item	Midterm			Final			Difference		F-Ratio
	N	M	SD	N	M	SD	Mid - Fin		
13. Speech	49	2.92	1.77	44	3.14	1.56	-.22	0.39	
14. Tolerance	48	1.98	1.36	44	2.36	1.35	-.38	1.85	
15. Sense of Humor	49	2.27	1.27	42	2.83	1.65	-.56	3.43	
16. Personal Appearance	48	2.04	1.41	44	2.34	1.18	-.30	1.20	
17. Relationship between Students and Instructor ^c	49	2.31	1.39	44	2.39	1.37	-.08	0.08	

^aDifference was obtained by subtracting the final mean rating from the midterm mean rating.
A positive difference indicates a more favorable final rating.

^bThe critical ratio is 4.08 for the 0.05 level of significance.

^cQualities listed in first research hypothesis.

APPENDIX D

TABLE 1

NUMBER, MEAN, AND STANDARD DEVIATION FOR MIDTERM AND FINAL STUDENT RATINGS
OF ECONOMICS INSTRUCTOR FOR CONTROL AND EXPERIMENTAL SECTIONS

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
1. Organization of Course	41	2.66	1.39	33	2.73	1.44	41	3.54	1.90	50	2.60	1.59
2. Preparation for Each Class	41	2.32	1.29	33	2.48	1.52	41	3.00	1.95	50	2.02	1.12
3. Teaching Skill	39	3.69	1.92	32	3.50	1.92	40	4.10	2.25	47	2.49	1.46
4. Enthusiasm and Interest in Course	41	3.05	1.50	33	2.94	1.58	41	3.37	2.06	50	2.34	1.30
5. Assignments	39	1.46	1.55	33	2.70	1.76	40	3.63	2.13	47	3.13	1.86
6. Judgment of Values	41	2.39	1.34	33	2.48	1.46	40	2.70	1.59	50	2.12	1.15
7. Class Discussion and Questions	41	2.37	1.39	37	2.42	1.52	40	2.98	2.02	50	2.24	1.74
8. Poise and Self Confidence	41	1.63	1.07	32	2.00	1.37	41	2.10	1.55	50	1.74	1.08
9. Examinations	40	1.95	1.01	33	2.33	1.49	40	2.65	1.67	49	1.88	1.01
10. Scholarship	41	1.98	1.06	32	2.06	1.11	41	2.44	1.45	49	1.84	1.03
11. Ability to Create Student Interest	41	3.95	1.80	33	3.70	1.70	41	4.20	2.17	50	3.36	2.01
12. Classroom Management and Discipline	41	1.93	1.10	33	2.06	1.03	40	2.58	1.41	49	2.12	1.24

Table 1 -- Continued

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
13. Speech	41	2.59	1.61	33	3.12	1.69	40	2.92	1.73	50	2.06	1.20
14. Tolerance	41	1.66	0.85	33	1.58	1.03	40	2.02	1.51	50	1.60	0.88
15. Sense of Humor	41	2.49	1.61	32	3.56	1.61	40	2.75	2.05	50	1.98	1.25
16. Personal Appearance	40	1.82	1.06	33	1.81	1.07	41	2.15	1.33	50	1.76	0.96
17. Relationship between Students and Instructor	41	1.83	1.12	31	1.61	0.92	40	2.18	1.26	50	1.90	1.27

TABLE 2

NUMBER, MEAN, AND STANDARD DEVIATION FOR MIDTERM AND FINAL STUDENT RATINGS
OF CHEMISTRY INSTRUCTOR FOR CONTROL AND EXPERIMENTAL SECTIONS

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
1. Organization of Course	36	2.92	1.57	43	3.19	1.28	20	2.35	1.39	25	2.36	1.38
2. Preparation for Each Class	36	2.08	1.08	43	2.42	1.31	21	1.71	1.06	25	2.12	1.27
3. Teaching Skill	36	3.81	1.95	42	3.79	1.69	20	3.35	1.63	25	2.84	1.46
4. Enthusiasm and Interest in Course	36	3.17	1.36	43	3.02	1.28	21	3.57	1.94	25	2.72	1.02
5. Assignments	36	3.33	1.72	43	3.95	1.79	21	3.19	1.66	23	3.09	1.50
6. Judgment of Values	35	2.57	1.12	43	2.53	1.28	20	3.00	1.12	25	2.36	1.68
7. Class Discussion and Questions	36	2.92	1.75	41	2.88	1.68	20	2.65	1.35	24	2.88	2.17
8. Poise and Self Confidence	36	2.11	1.88	43	2.12	1.40	20	2.85	1.66	25	1.76	0.88
9. Examinations	36	2.22	0.99	42	2.55	1.31	21	2.38	0.97	25	2.32	1.31
10. Scholarship	36	1.36	0.68	43	1.95	1.02	21	1.43	0.75	24	1.33	0.70
11. Ability to Create Student Interest	36	3.64	1.64	43	4.02	1.82	21	4.29	2.05	25	3.32	1.65
12. Classroom Management and Discipline	36	2.44	1.44	43	2.63	1.35	21	2.38	1.60	25	2.08	1.47

TABLE 2--Continued

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
13. Speech	36	1.83	1.11	43	2.28	1.40	21	1.95	1.24	25	1.56	1.04
14. Tolerance	36	3.78	2.17	43	3.16	1.80	21	4.71	1.95	24	3.25	1.85
15. Sense of Humor	36	2.81	1.95	43	2.63	1.56	20	3.35	1.90	25	2.44	1.42
16. Personal Appearance	35	2.20	1.97	42	2.31	1.39	21	1.86	1.24	24	1.50	0.78
17. Relationship between Students and Instructor	36	2.89	1.60	43	2.63	1.51	21	3.57	2.29	25	2.12	1.30

TABLE 3

NUMBER, MEAN AND STANDARD DEVIATION FOR MIDTERM AND FINAL STUDENT RATINGS
OF PHYSICAL SCIENCE INSTRUCTOR FOR CONTROL AND EXPERIMENTAL SECTIONS

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
1. Organization of Course	57	2.05	1.09	48	1.85	0.96	51	2.24	1.19	51	1.82	0.87
2. Preparation for Each Class	57	2.09	1.07	48	1.81	0.96	51	2.22	1.15	51	1.90	0.85
3. Teaching Skill	57	1.86	1.27	49	1.51	0.71	51	1.84	1.01	49	1.78	0.87
4. Enthusiasm and Interest in Course	57	1.86	1.11	48	1.50	0.77	51	1.90	1.06	51	1.65	0.93
5. Assignments	57	2.00	1.38	49	1.78	1.05	49	1.69	0.87	48	1.81	0.96
6. Judgment of Values	56	1.79	0.87	49	1.61	0.70	51	2.12	0.95	51	1.90	0.94
7. Class Discussion and Questions	57	2.40	1.36	48	2.23	1.21	49	2.18	1.09	51	2.67	1.28
8. Poise and Self Confidence	57	1.54	0.91	48	1.25	0.48	51	1.90	1.08	51	1.92	1.16
9. Examinations	57	2.37	1.33	49	2.47	1.54	51	2.37	1.33	51	2.55	1.39
10. Scholarship	56	1.77	0.91	49	1.65	0.86	51	2.35	1.00	49	2.06	0.94
11. Ability to Create Student Interest	57	2.00	1.07	49	1.61	0.95	50	2.00	1.23	51	2.00	0.89
12. Classroom Management and Discipline	56	1.80	1.00	48	1.56	0.99	51	1.84	1.22	51	1.65	0.87

TABLE 3 --Continued

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
13. Speech	57	1.32	0.76	49	1.18	0.49	50	1.40	1.23	51	1.22	0.50
14. Tolerance	57	1.93	1.24	48	1.52	0.74	50	1.84	1.43	51	1.96	1.39
15. Sense of Humor	57	1.11	0.36	48	1.04	0.20	51	1.37	1.17	51	1.24	0.59
16. Personal Appearance	57	1.25	0.81	49	1.18	0.49	51	1.31	0.95	51	1.22	0.58
17. Relationship between Students and Instructor	57	1.46	0.91	49	1.22	0.51	51	1.43	1.04	50	1.46	0.86

TABLE 4

NUMBER, MEAN, AND STANDARD DEVIATION FOR MIDTERM AND FINAL STUDENT RATINGS
OF ANTHROPOLOGY INSTRUCTOR FOR CONTROL AND EXPERIMENTAL SECTIONS

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	MM	SD	N	M	SD	N	M	SD
1. Organization of Course	26	2.65	1.29	26	1.96	1.25	22	2.64	1.26	28	2.00	1.09
2. Preparation for Each Class	26	2.27	0.96	26	1.92	1.23	22	2.14	1.08	28	1.86	0.97
3. Teaching Skill	26	3.23	1.61	26	2.81	1.67	22	2.77	1.51	28	2.14	1.04
4. Enthusiasm and Interest in Course	26	2.85	2.17	22	2.32	1.60	22	2.18	1.18	27	1.70	1.04
5. Assignments	26	2.42	1.77	25	2.64	2.29	22	2.09	1.31	28	1.93	1.11
6. Judgment of Values	24	2.62	1.33	25	2.20	0.87	22	2.64	1.26	28	2.04	0.84
7. Class Discussion and Questions	25	3.40	1.86	26	2.85	1.99	22	2.95	1.50	28	2.57	1.71
8. Poise and Self Confidence	25	3.40	1.87	25	3.56	2.25	22	2.86	1.75	28	2.25	1.00
9. Examinations	26	2.77	1.83	26	2.88	2.24	22	3.36	1.56	26	2.81	1.21
10. Scholarship	26	2.04	1.04	25	1.96	1.06	22	2.00	1.31	28	1.86	0.98
11. Ability to Create Student Interest	22	3.32	1.79	24	3.00	1.86	22	2.86	1.67	27	2.15	1.73
12. Classroom Management and Discipline	26	1.88	1.15	26	2.08	1.07	22	2.27	1.35	28	1.96	0.90

TABLE 4--Continued

ITEM	CONTROL						EXPERIMENTAL					
	MIDTERM			FINAL			MIDTERM			FINAL		
	N	M	SD	N	M	SD	N	M	SD	N	M	SD
13. Speech	26	2.69	1.41	25	2.16	1.06	22	2.50	1.06	27	2.07	1.14
14. Tolerance	26	2.96	1.71	26	2.88	1.89	22	3.09	2.24	28	2.04	1.34
15. Sense of Humor	26	2.69	2.02	26	2.65	1.83	22	2.27	2.12	26	1.69	1.08
16. Personal Appearance	26	2.12	1.42	26	2.12	1.07	22	2.09	1.23	28	1.79	1.38
17. Relationship between Student and Instructor	26	2.19	1.72	26	2.08	1.57	22	2.14	1.21	28	1.57	0.89

BIOGRAPHICAL NOTE

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Hammond High School, 1947-49

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University of Illinois, 1951-55 B.S. in the Teaching of
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University of Washington, 1969-71 Ph.D. in Higher Education
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